

# Transboundary River Basins

*Status and Trends*

**SUMMARY FOR POLICY MAKERS**



**VOLUME 3: RIVER BASINS**

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#### **Administrative Boundaries**


Source of administrative boundaries used throughout the assessment: The Global Administrative Unit Layers (GAUL) dataset, implemented by FAO within the CountrySTAT and Agricultural Market Information System (AMIS) projects.

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# Summary for Policy Makers

The *Transboundary River Basins Assessment* is a global, comparative, baseline assessment of 286 transboundary river basins, and the most comprehensive assessment of such river basins to date.

## Key Messages and Recommendations

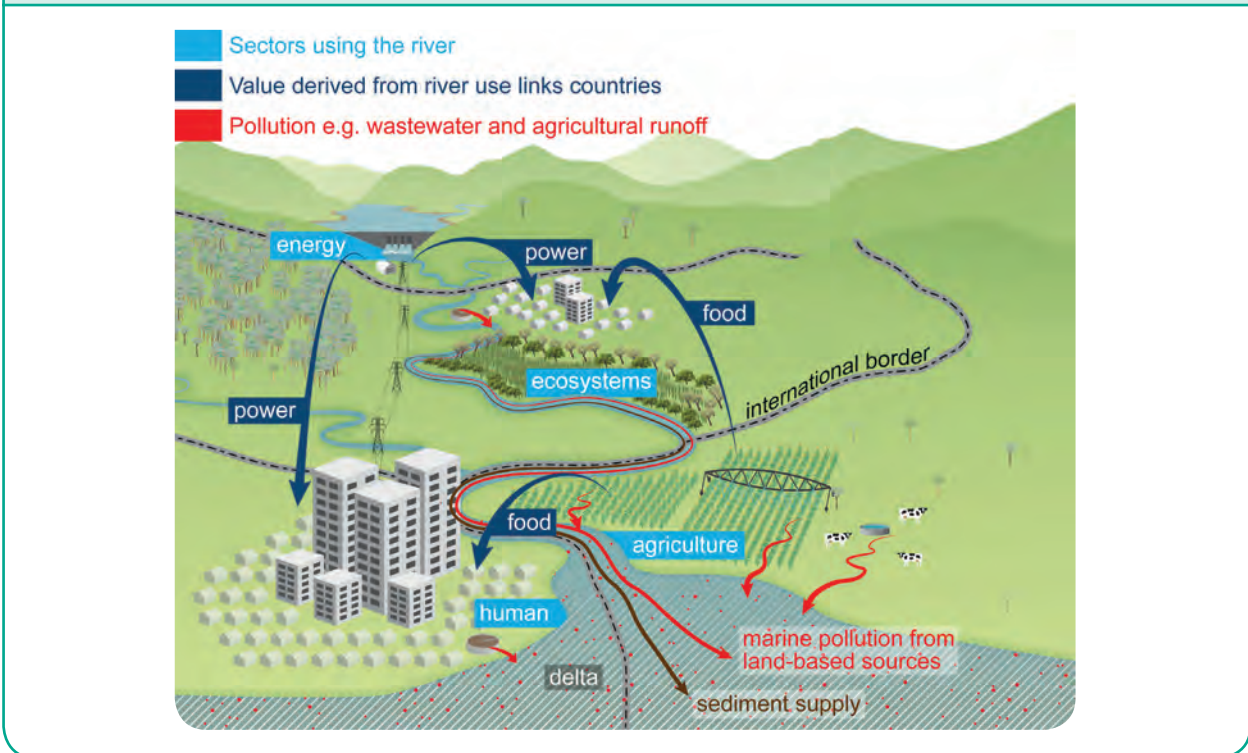
1. Environmental, human and agricultural water stresses often occur in the same transboundary river basins, resulting in competition for water between sectors and between countries. Relative risk for any of these stresses is high or very high in 41 out of 286 basins. **Actions to mitigate water stress need to be planned in an integrated, cooperative framework to take careful consideration of all sectors in each country sharing a basin.**
2. Pollution risks in many transboundary river basins are high and projected to increase. Relative risk for either nutrient pollution or wastewater pollution is high or very high in 218 out of 286 basins. **Improved wastewater treatment and nutrient management in agriculture are needed in most basins.**
3. The threat to freshwater biodiversity is global. Extinction risk is moderate to very high in 70% of the area of transboundary river basins. **However, local-level, tailored solutions are needed to address species extinction risks.**
4. The construction of dams and water diversions is in progress or planned in many transboundary river basins, sometimes without adequate international water cooperation instruments. **While many transboundary agreements exist, more effort is needed to update them to reflect modern principles of transboundary water management, such as the obligation not to cause significant harm and the principles of cooperation and information exchange.**
5. **Continuing commitment is needed to improve guidelines for siting new dams, designing dams for multiple purposes, and optimising the operation of dams to maximise human benefits and minimise negative ecosystem impacts and sediment trapping.** This is particularly relevant in transboundary river basins, where dams are often in upstream countries.
6. Transboundary river basins with high economic dependence on water resources, low levels of societal wellbeing and high exposure to floods and droughts have the highest climate-related risks. These include the Limpopo, Ganges-Brahmaputra-Meghna and Mekong basins. **Governance capacity may need to be continually improved in basins with high climate-related risk.**
7. Almost all deltas in transboundary river basins have moderate to very high risk for one or more indicator. **Special attention should be paid to the impacts of upstream activities on deltas, in particular the reduction of sediment supply (resulting in sinking deltas) and of water flows due to dams and abstractions, and to pollution.**
8. Four groups of transboundary river basins have been identified where the basins within each group have similar risk profiles. **Opportunities for common management strategies within each of these groups should be explored. They offer scope for learning between regions.**
9. Risks are projected to increase in the next 15-30 years, particularly for four hotspot regions: the Middle East, Central Asia, the Ganges-Brahmaputra-Meghna basin, and the Orange and Limpopo basins in Southern Africa. **Action should be taken now to reduce future costs and impacts.**

The Transboundary Waters Assessment Programme (TWAP) was initiated by the Global Environment Facility (GEF) to create the first baseline assessment of all the planet’s transboundary water resources. The *Transboundary River Basins Assessment* is one of five assessments of transboundary water systems (see [www.geftwap.org](http://www.geftwap.org)).

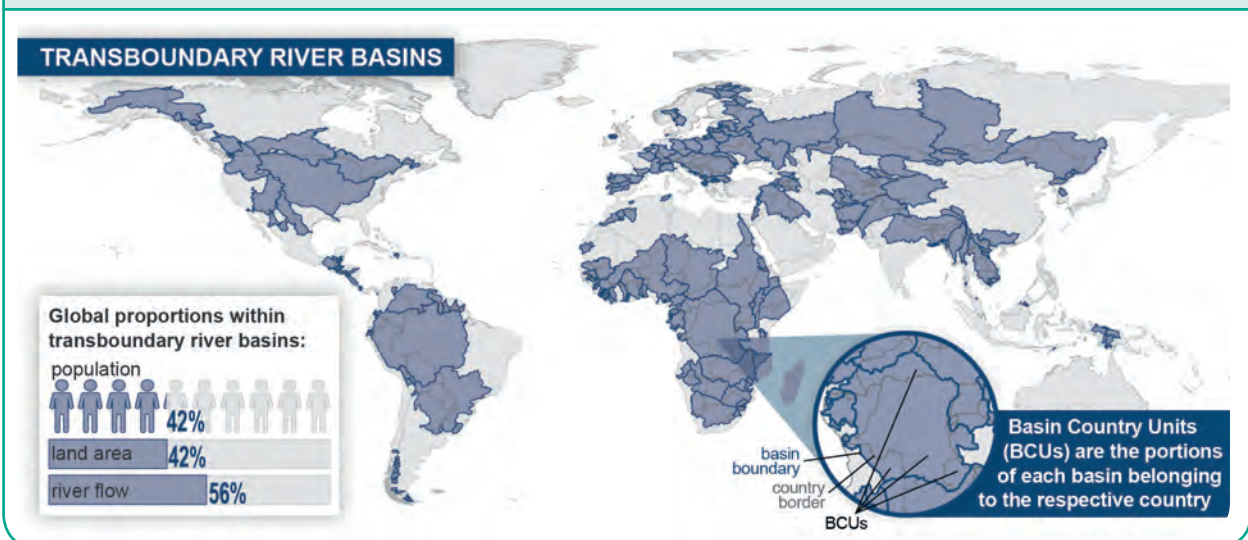
The *Transboundary River Basins Assessment* is an indicator-based assessment, which identifies and classifies river basins at risk from a variety of issues, encourages knowledge exchange, and increases awareness of the importance and state of transboundary waters.

As activities in river basins often affect their deltas, 26 deltas have also been assessed.





**Transboundary rivers cross borders.** Countries that share a river basin are linked through their use of the water, the value they derive from it, and the impacts they cause through development and pollution.



**The world’s transboundary river basins link countries in a common future.** They support the socioeconomic development and wellbeing of humanity and are home to a high proportion of the world’s biodiversity. 151 countries and 2.8 billion people share 286 transboundary river basins.



15 core indicators across 5 thematic groups are assessed. Projections are made for five of these indicators, and linkage indicators cover lakes and deltas.

THEMATIC GROUPS		INDICATORS	
		Baseline (2010)	Projected (2030 & 2050)
 <b>Water quantity</b>		1. Environmental water stress 2. Human water stress 3. Agricultural water stress	<ul style="list-style-type: none"> <li>• Environmental water stress</li> <li>• Human water stress</li> </ul>
		4. Nutrient pollution 5. Wastewater pollution	<ul style="list-style-type: none"> <li>• Nutrient pollution</li> </ul>
 <b>Ecosystems</b>		6. Wetland disconnectivity 7. Ecosystem impacts from dams 8. Threat to fish 9. Extinction risk	<ul style="list-style-type: none"> <li>• [Environmental water stress]</li> </ul>
		10. Legal framework 11. Hydropolitical tension 12. Enabling environment	<ul style="list-style-type: none"> <li>• Exacerbating factors to hydropolitical tension</li> </ul>
 <b>Socioeconomics</b>		13. Economic dependence on water resources 14. Societal wellbeing 15. Exposure to floods and droughts	<ul style="list-style-type: none"> <li>• Change in population density</li> </ul>
 <b>Water systems links</b>	<b>Lakes</b>	<ul style="list-style-type: none"> <li>• Lake influence</li> </ul>	
	<b>Deltas</b>	<ul style="list-style-type: none"> <li>• Relative sea level rise</li> <li>• Wetland ecological threat</li> <li>• Population pressure</li> <li>• Delta governance</li> </ul>	

This is the first assessment to look at transboundary river systems with this scope and on this scale. The analysis has been carried out for river basins and for the portions of each basin belonging to the respective country (referred to as Basin Country Units, see figure on previous page). The assessment, and the partnership of institutions established, can provide support to a broad variety of stakeholders, organizations and initiatives at multiple scales, from global to local. These include the UN Watercourses Convention (which came into force in 2014) and the UNECE Water Convention (open to all countries in 2015), the Sustainable Development Goals, regional economic commissions, donors, international organizations, basins, deltas and countries.



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# Selected results

The results for all indicators are too many to show here. Examples of one indicator result map and key finding from each thematic group are provided below. The assessment paints a complex picture, and combining all indicators into a simple index to rank all basins fails to reflect the diversity of risks. The results and analysis in the report, and the tools available in an interactive data portal, allow users to examine a range of issues to obtain a more nuanced picture (<http://twap-rivers.org/indicators>).

**Water quantity** **Transboundary river basins have varying uses in different countries.** The Environmental (below), Human and Agricultural Water Stress indicators often depict high stresses in the same basins, highlighting competition for water between sectors and between countries. In some basins, poor water quality exacerbates water stress.

### ENVIRONMENTAL WATER STRESS

**Metric:** Monthly changes to natural flow conditions

**Categories:** Relative risk by transboundary river basin

<b>40%</b>	<b>36%</b>	<b>7%</b>	<b>5%</b>	<b>6%</b>	<b>6%</b>
very low	low	moderate	high	very high	no data

**KEY FINDING**

Flow regimes have been significantly altered by dam management and water consumption, and environmental water stress is projected to increase due to climate change (especially in drier regions and where snowmelt plays a crucial role) and increasing water consumption.

Very high relative risk transboundary river basins for Environmental Water Stress: Cancoso/Lauca, Colorado, Dasht, Guadiana, Hamun-i-Mashkel/ Rakshan, Hari/Harirud, Jordan, Kowl E Namaksar, Murgab, Rio Grande (North America), Tarim.

**Water quality** **Water pollution often has impacts on downstream countries.** The Nutrient Pollution (below) and Wastewater Pollution indicators illustrate water quality issues in basins and their receiving coastal waters.

### NUTRIENT POLLUTION

**Metric:** Nitrogen and phosphorous concentrations using the Nutrient Export from Watersheds model

**Categories:** Relative risk by transboundary river basin

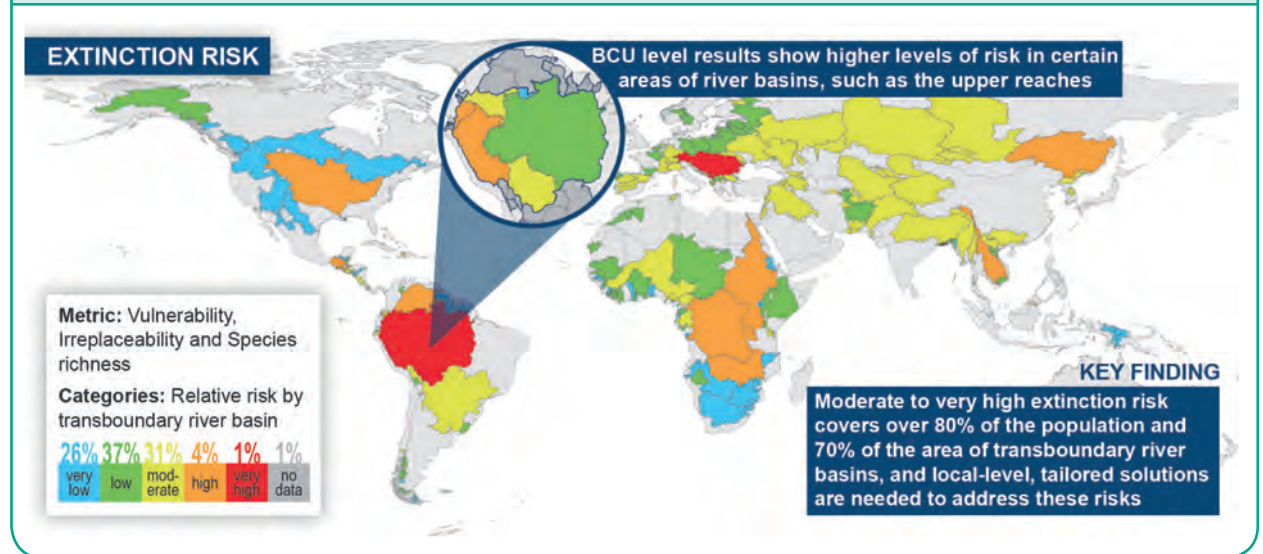
<b>2%</b>	<b>37%</b>	<b>27%</b>	<b>21%</b>	<b>10%</b>	<b>2%</b>
very low	low	moderate	high	very high	no data

**KEY FINDING**

1.4 billion people, half the population living in transboundary river basins, face serious and increasing nutrient pollution risks. The projected scenario suggests that, between 2000 and 2030, more than 30 basins will increase in risk.

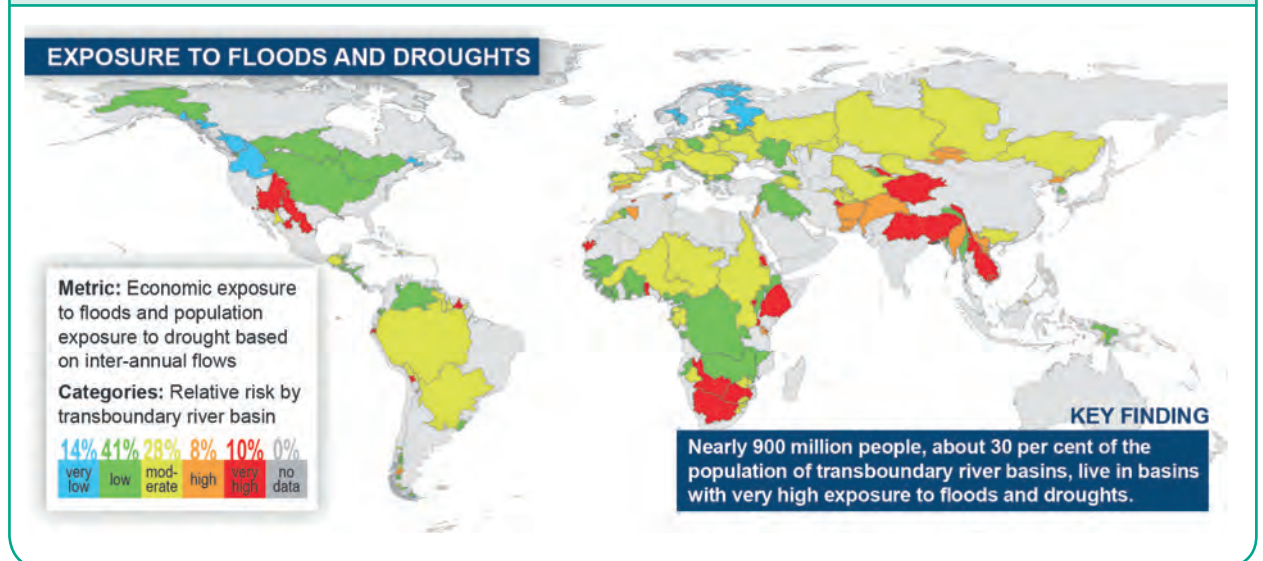
Very high relative risk transboundary river basins for Nutrient Pollution: Bei Jiang/Hsi, Elbe, Ganges-Brahmaputra-Meghna, Jordan, Limpopo, Ma, Rhine, Seine.

**Ecosystems** Human development usually impacts ecosystems, which often negatively impacts human livelihoods and health in the long term. The Wetland Disconnectivity, Ecosystem Impacts from Dams, and Threat to Fish indicators all represent pressures which can result in Species Extinction Risk (below).



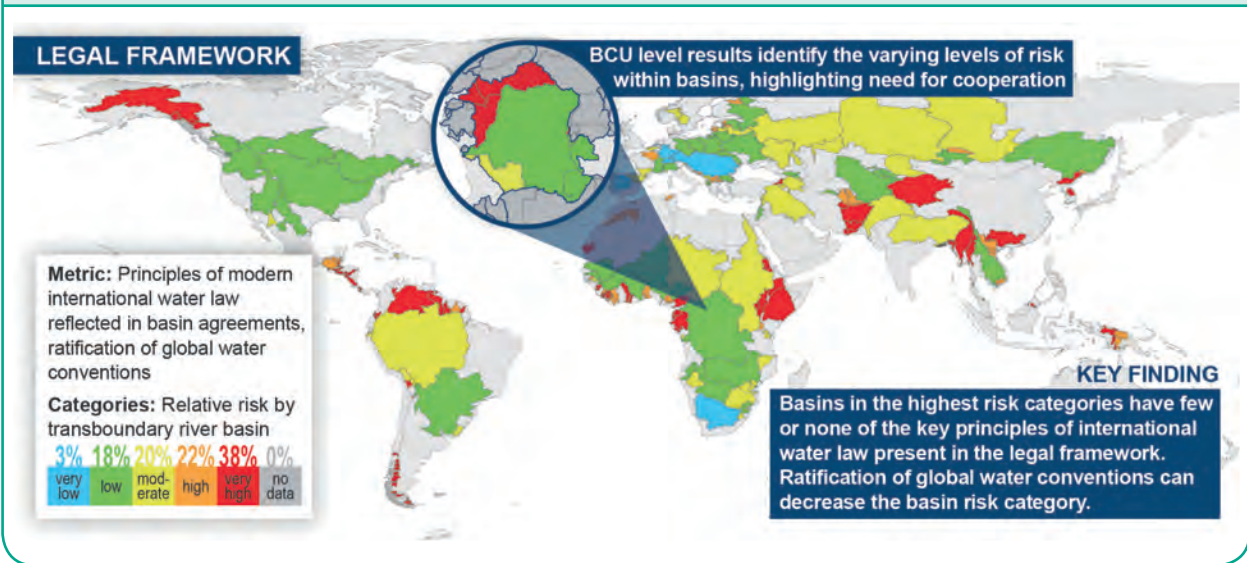
Very high relative risk transboundary river basins for Extinction Risk: Amazon, Danube. Very high relative risk BCUs include: Albania and Macedonia (Drin), China (Bei Jiang/His), Guatemala and Mexico (Grijalva), United States (Mississippi).

**Socioeconomics** The challenges are not restricted to water, but include a broad spectrum of socioeconomic development objectives. These are represented by the Societal Wellbeing, Economic Dependence on Water Resources, and Exposure to Floods and Droughts indicators (below). Results from these identify basins where human vulnerability to a range of climate and development impacts is high.



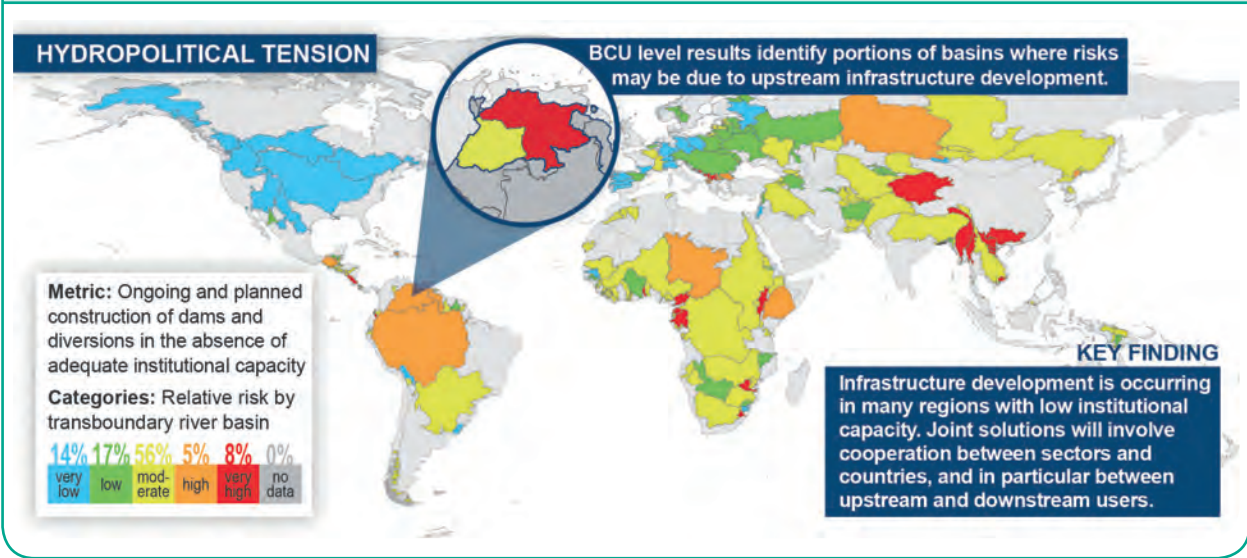
Very high relative risk transboundary river basins for Exposure to Floods and Droughts: Atui, Baraka, Cancoso/Lauca, Colorado, Ganges-Brahmaputra-Meghna, Juba-Shibeli, Kowl E Namaksar, Lake Natron, Limpopo, Lotagipi Swamp, Maroni, Mekong, Okavango, Orange, Oueme, Rio Grande (North America), Saigon, Shu/Chu, Tarim.

**Governance** The wealth and diversity of the report’s findings make it clear that greater transboundary cooperation is needed to address risks to river systems. The Legal Framework indicator (below) shows the existence of basin treaties and the extent to which key principles of transboundary water management (such as the obligation not to cause significant harm and the principles of cooperation and information exchange), are included in them.



Very high relative risk transboundary river basins for Legal Framework: Alsek, Atui, Awash, BahuKalat/Rudkhanehye, Baker, Baraka, Bei Jiang/Hsi, Benito/Ntem, Cancoso/Lauca, Catatumbo, Coco/Segovia, Corantijn/Courantyne, Coruh, Dasht, Digul, Essequibo, Gash, Hamun-i-Mashkel/Rakshan, Han, Helmand, Irrawaddy, Juba-Shibeli, Kaladan, Komoe, Kowl E Namaksar, Nyanga, Ogooue, Oiapoque/Oyupock, Orinoco, Patia, Salween, San Juan, Sanaga, St. Paul, Stikine, Tami, Tarim, Tumen, Yalu, Yukon.

**Governance** The Hydropolitical Tension indicator shows that the construction of new water infrastructure is in progress or planned in many transboundary basins, including in areas where international water cooperation instruments are still absent or limited in scope. Cooperation will inevitably involve joint solutions between sectors and countries, and in particular between upstream and downstream users.

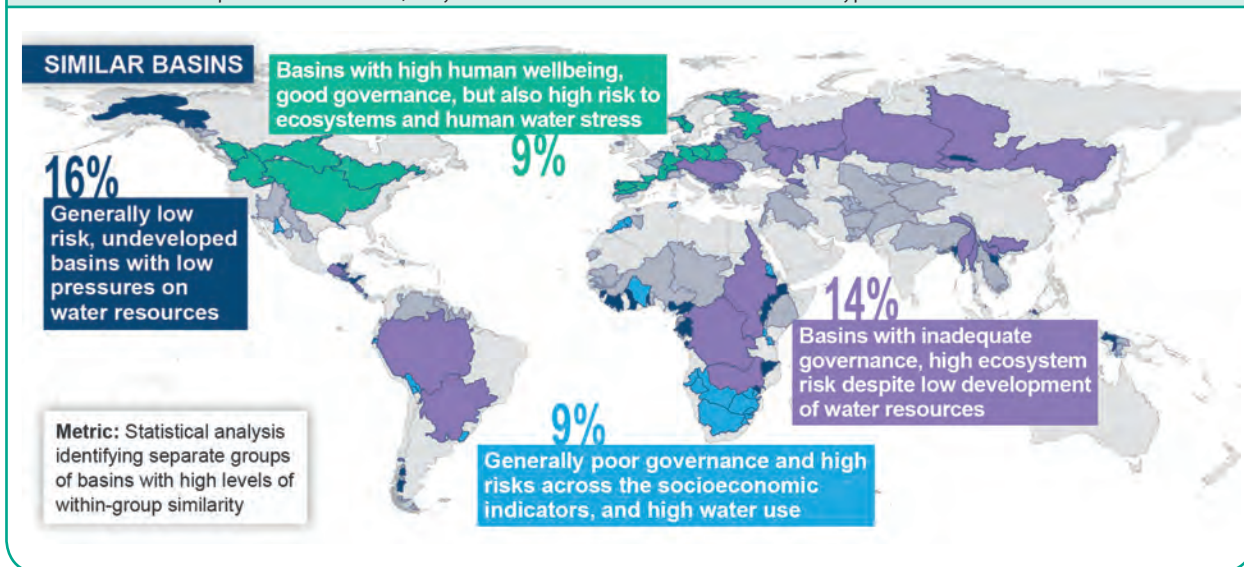


Very high relative risk transboundary river basins for Hydropolitical Tension: Bei Jiang/Hsi, Benito/Ntem, Ca/Song-Koi, Drin, Irrawaddy, Lake Turkana, Ma, Mira, Mono, Ogooue, Red/Song Hong, Sabi, Saigon, Salween, San Juan, Sanaga, Tarim, Thukela, Vardar.

Governance capacity at the national level underpins the ability to respond to risks at the transboundary level, as assessed by the Enabling Environment indicator.

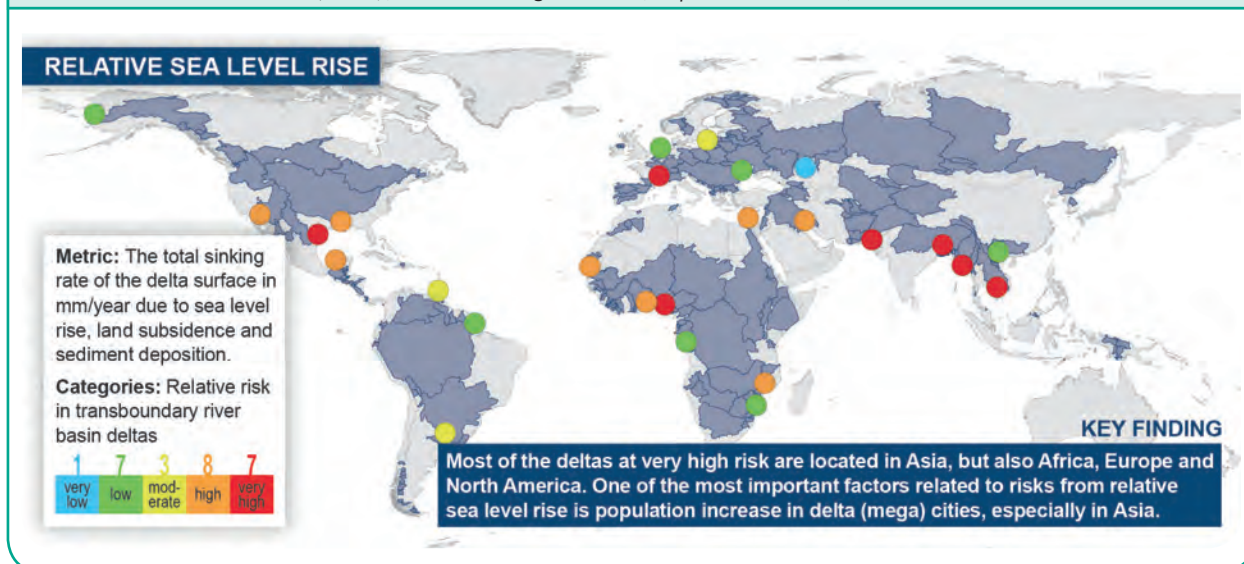


**Similar basins** **Groups of basins with similar risk profiles.** Common risk profiles can facilitate inter-basin learning and shared approaches to management. In some of these basins, more detailed assessments of governance / capacity may be warranted, particularly where other risks are also high. The four groups below are not necessarily associated with higher or lower risk compared to each other, only that the basins within them face similar types of risk.



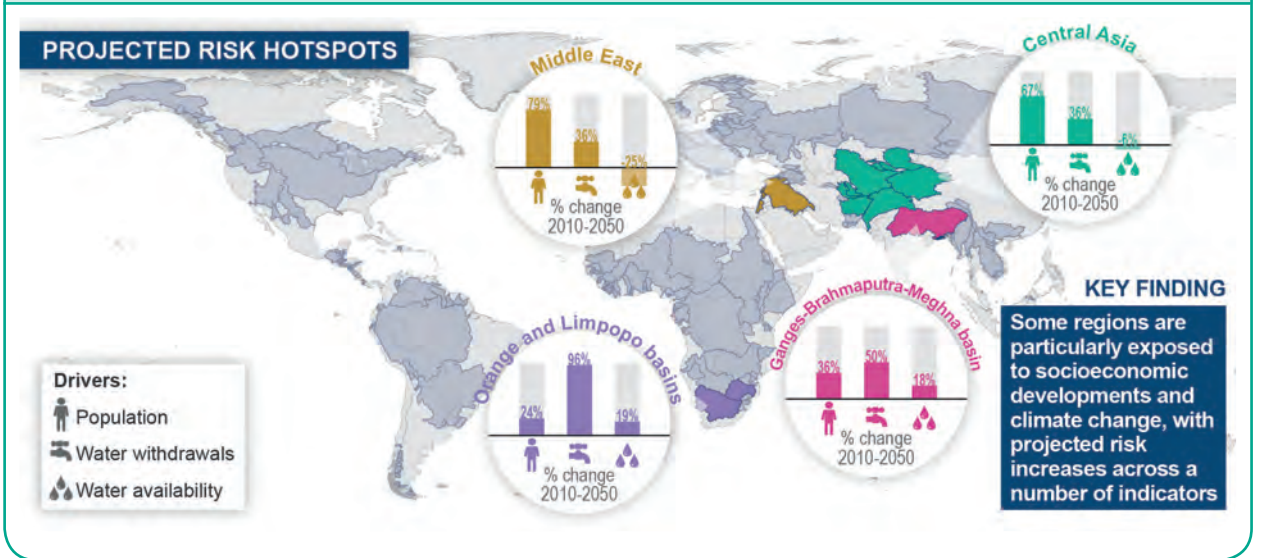
For a list of transboundary river basins in each group, see Transboundary River Basins: Status and Trends (UNEP-DHI and UNEP 2016).

**Water systems links** **With some 80% of marine pollution coming from land-based sources, special attention should be paid to the impact of upstream interventions on the most vulnerable river deltas and coastal areas, particularly the reduction of sediment supply (resulting in sinking deltas) and river flows caused by dams.** Deltas indicators include Relative Sea Level Rise (below), Wetland Ecological Threat, Population Pressure, and Delta Governance.



Very high relative risk deltas for Relative Sea Level Rise: Ganges-Brahmaputra-Meghna, Indus, Irrawaddy, Mekong, Niger, Rhone, Rio Grande.

**Projections** Results from the ‘business-as-usual’ projections analysis show that many of the risks to transboundary river basins are projected to increase in the next 15-30 years with a changing climate, socioeconomic development, and increasing populations. Four hotspots are identified, based on the combined projected impacts for five indicators: Environmental Water Stress, Human Water Stress, Nutrient Pollution, Exacerbating Factors to Hydropolitical Tension, and Change in Population Density. The figure also shows the percentage change in three key drivers (population, water withdrawals, and water availability) from 2010 to 2050. Despite projected increases in water availability in the Ganges-Brahmaputra-Meghna basin and the Orange and Limpopo basins, water withdrawals are projected to increase by a greater amount. Water demand reduction strategies are part of the solution in all four hotspots, but particularly in these two, where water withdrawals are projected to exceed population increases.



Middle East transboundary river basins: Aral Sea, Hari, Helmand, Ili, Indus, Murgab, Shu, Talas and Tarim. Central Asia transboundary river basins: Jordan, Euphrates, Orontes and Tigris-Euphrates/Shatt al Arab.

The transboundary river basins of the world provide vital resources for nearly half of the world’s population. This assessment shows existing and increasing risks in the majority of these basins. Establishing political will and transboundary cooperation frameworks, as well as improving economic and technical capacity at both the national and transboundary level, will be crucial in managing these risks and maintaining healthy rivers and deltas for the future.

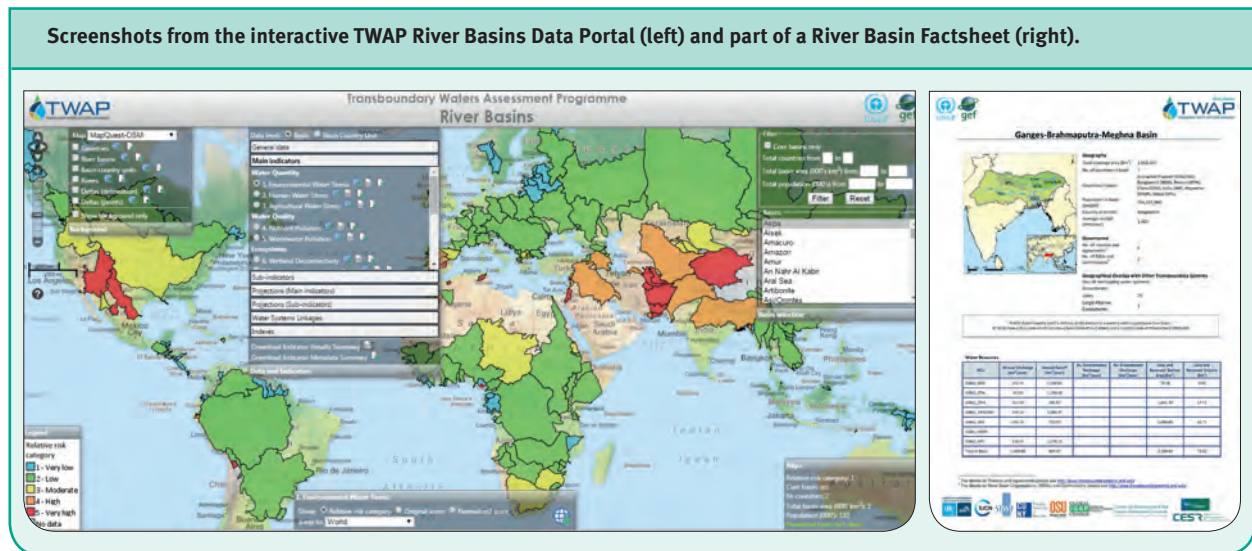


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## Online resources to learn more about your rivers, regions and interests

If you want to learn more about your country, a particular transboundary river basin or issue such as water scarcity, you can conduct your own data searches, undertake analysis such as creating indices, and download River Basin Factsheets in the interactive Data Portal, accessible from the website <http://twap-rivers.org/>.

Also available on the website is a briefing document, titled the *Transboundary River Basins Technical Summary*, the full length *Transboundary River Basins Report*, and the *TWAP River Basins Sustaining Mechanisms Report*



TWAP programme level website and data portal [www.geftwap.org](http://www.geftwap.org)

## Acknowledgements

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The water systems of the world — aquifers, lakes, rivers, large marine ecosystems, and open ocean — sustain the biosphere and underpin the health and socioeconomic wellbeing of the world's population. Many of these systems are shared by two or more nations. These transboundary waters, stretching over 71% of the planet's surface, in addition to the subsurface aquifers, comprise humanity's water heritage.

Recognizing the value of transboundary water systems, and the reality that many of them continue to be overexploited and degraded, and managed in fragmented ways, the Global Environment Facility (GEF) initiated the Transboundary Waters Assessment Programme (TWAP). The Programme aims to provide a baseline assessment to identify and evaluate changes in these water systems caused by human activities and natural processes, as well as the consequences these changes may have on the human populations dependent upon them. The institutional partnerships forged in this assessment are also envisioned to seed future transboundary assessments.

The final results of the GEF TWAP are presented in the following six volumes:

Volume 1 – *Transboundary Aquifers and Groundwater Systems of Small Island Developing States: Status and Trends*

Volume 2 – *Transboundary Lakes and Reservoirs: Status and Trends*

Volume 3 – *Transboundary River Basins: Status and Trends*

Volume 4 – *Large Marine Ecosystems: Status and Trends*

Volume 5 – *The Open Ocean: Status and Trends*

Volume 6 – *Transboundary Water Systems: Crosscutting Status and Trends*

A *Summary for Policy Makers* accompanies each volume.

This document — Volume 3 Summary for Policy Makers — showcases the first truly global baseline assessment of the world's 286 transboundary river basins that include 151 countries, and in which more than 40% of the earth's population live.

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