

# WATER COOPERATION for a SECURE WORLD

Focus on the Middle East





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with support from  
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## Preface

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Ban Ki Moon, Secretary General of the United Nations, has expressed concern on several occasions about linkages between water, peace, conflicts and security. Water cooperation between countries sharing trans-boundary water resources is directly correlated with security of nations involved in such cooperation and peace in the continent or subcontinent they belong to. Conversely, absence of active water cooperation is directly correlated with risk of war between countries sharing trans-boundary water resources. Nevertheless, many countries shy from discussing the centrality of water in the wider security paradigm. Many countries find it convenient to limit public discourse on water to development and health issues. Of course, development and health are of paramount importance. But recognising the role of water in development process is no excuse for not acknowledging how central water cooperation is for security of several regions and the world at large. Convenient or inconvenient, truth does prevail. Merely avoiding discussion on it does not make truth disappear from the real world. In fact, lack of considered discussion can create the risk of the truth manifesting itself in forms which are undesirable for people and the environment.

This report states the truth as it prevails and as proved by facts and figures of situation on the ground. Out of 148 countries having trans-boundary water resources, 37 face the risk of war and they are home to more people on the earth than others. These are precisely the countries which have avoided active water cooperation with their neighbours.

Alas, the Middle East is the primary theatre of war and risk of war in future, because most countries in the Middle East have rejected the idea of trans-boundary cooperation in water. A few treaties have been signed. Some training programmes have been held. Several meetings of officials have taken place. But they have yielded no result because of lack of vigorous political commitment to the idea of cooperation. On the surface, the leaders in the Middle East have spoken in favour of cooperation, as their quotes in this report prove. Beneath the surface, these words have not translated into programmes and actions.

While the Middle East has frozen the clock of cooperation, several countries in Africa, Asia and Latin America, having similar economic realities and complex histories, are moving ahead in cooperation for sustainable management of their trans-boundary water resources. Obviously countries in North America and Europe are on the same path. But cooperation is not a prerogative of developed OECD countries. It is a priority for countries in West Africa, Southern Africa, Central America, Southeast Asia, which have experienced underdevelopment, wars, dictatorships and cultural differences. To say that water cooperation is not relevant to a particular part of the world because of its specific political or cultural characteristics is to close one's eyes to winds of progress taking place in every continent.

This report presents a detailed analysis of ten successful regional water cooperation arrangements, including details of their treaties, structures, processes and operational realities. If the countries in the Middle East want to construct a suitable model of a regional water cooperation arrangement or a river basin organisation, the report has several examples. The countries in the Middle East can adapt any of the existing examples or blend features of different institutions which would be most appropriate for them.

This report has resulted from exchange of experiences between experts in the Middle East and those from other parts of the world. Some of it was direct while some was indirect through the SFG project team. A conference in Istanbul in March 2013 was particularly useful where senior experts from the Rhine Commission, Danube Commission and India Bangladesh Joint Rivers Commission provided detailed analysis of their experiences and engaged in substantive exchange of perspectives with experts, politicians and media leaders from the Middle East. The process of experience exchange will go on for the next several months.

We are grateful to the Swedish International Development Cooperation Agency (Sida) for their support to this project. We are also grateful to the Swiss Agency for Development and Cooperation (SDC) as this project benefitted from a parallel project on regional water cooperation in the Middle East undertaken by SFG in cooperation with SDC. We also benefitted from insights acquired in a global water security initiative consultations process assigned by SDC. We also wish to place on record our gratitude to Turkish Review journal published by the Zaman Group in Turkey, The Rt Hon Lord Alderdice, Chairman of the Liberal Democrat Parliamentary Party in the House of Lords of the UK Parliament and Royal Scientific Society of Jordan for facilitating various workshops and discussions.

The project on experience exchange between the Middle East and other regions was closely aligned with the High Level Group initiative of SDC, chaired by HRH Prince Hassan bin Talal. We are delighted that HRH Prince Hassan is now also the chairman of the UN Secretary General's Advisory Board on Water and Sanitation. His guidance, friendship and leadership have been critical to the SFG work in the Middle East.

While we are indebted to the governments, institutions and individuals mentioned above, it must be clarified that they do not own any responsibility for the analysis and observations in this report. Their support to our work is not an endorsement of this report. The responsibility for the analysis and all the contents of this report is solely of the Strategic Foresight Group.

We hope that this report will provide new evidence and ideas to shape the debate on water and peace, especially since the United Nations has declared 2013 as the International Year for Water Cooperation. The concerns about the dynamics between water and security articulated by the UN Secretary General are significant and the international community must address them. We hope that the Middle East is the place where the process of rethinking will begin.

Mumbai, September 2013

Sundeep Waslekar  
President

# Contents

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*Preface*

*Acronyms and Abbreviations*

## **Part I**

### **Chapter 1: Global Overview**

	1
1. Water and War Equation	2
2. Water Cooperation Quotient	20
3. Population at Risk	25
4. Disappearing Lakes	27
5. To Cooperate or to Complain?	28

### **Chapter 2: Middle East Overview**

	30
1. History of Water Cooperation	31
2. Dependency Ratios	32
3. Multiplicity of Crisis	33
4. Timeline of Cooperation	34
5. Depleting Rivers and Aquifers	36

## **Part II**

### **Introduction**

38

### **Chapter 1: Political Will**

40

1. Confidence Building Measures	41
2. Involvement of Regional and International Organizations	42
3. Joint Endeavours	44

### **Chapter 2: River Basin Organizations**

46

1. In Letter and in Spirit	47
2. Inclusion and Exclusion of Riparian Countries	48
3. Organizational Structures	49
4. Levels of Engagement	50
5. Functions	51
6. Nature of Decisions	54
7. Meetings	55

<b>Chapter 3: Legal Arrangements</b>	57
1. Treaties	58
2. Scope	59
3. Guiding Principles	60
4. Rights and Obligations of States	61
5. Finance and Dispute Resolution Mechanism	63
6. Provision for Revision or Amendment	64
7. Unique Provisions in Treaties	65
<b>Chapter 4: Sharing and Utilization</b>	66
1. Sharing Methods	67
2. Successful Examples	68
3. Guidelines	69
<b>Chapter 5: Data Management</b>	71
1. Data Collection and Monitoring	72
2. Exchange of Information	73
3. Types of Data Collection	74
4. Monitoring Stations	75
5. Frequency of Data Collection and Monitoring	78
6. Methods and Processes	79
<b>Chapter 6: Environment and Climate Change</b>	81
1. Environment Programmes	82
2. Key Environmental Issues	83
3. Quality Control	84
4. Climate Change Strategy	85
5. Collaborations with Third Parties	86
6. Conservation	89
7. Sustainable Development	90
<b>Chapter 7: Dispute Resolution Mechanisms</b>	94
1. Types of Dispute Resolution Mechanisms	95
2. Types of Disagreements	97
3. Past and Present Disputes	98
4. Notification, Consultation and Negotiation	100



<b>Chapter 8: Navigation</b>	103
1. Navigation Programmes	104
2. Benefits of Navigation	105
3. Building Blocks of Navigation System	107
4. Barriers to Navigation	108
5. Adverse Consequences	109
6. Environmental Protection Projects	110
<i>Annexure</i>	112
<i>Sources</i>	114

## Acronyms and Abbreviations

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ACTO	Amazon Cooperation Treaty Organization
ADB	Asian Development Bank
AfDB	African Development Bank
ANA	Brazilian National Water Agency
ANEEL	Brazilian Electricity Regulatory Agency
ASEAN	Association of Southeast Asian Nations
AusAid	Australian Agency for International Development
BCM	Billion Cubic Meters
BMZ	Bundesministerium Für Wirtschaftliche Zusammenarbeit (German Federal Ministry for Economic Cooperation and Development)
CCNR	Central Commission for the Navigation of the Rhine
CIC	Intergovernmental Coordinating Committee of the Plata Basin
Cida	Canadian International Development Agency
DFID	Department for International Development (U.K)
DGS	Department of Geological Survey
DWA	Department of Water Affairs
EAC	East African Community
ECOWAS	Economic Community of West African States
EF ZRB	Joint Zambezi River Basin Environmental Flows Programme
EU	European Union
EU WFD	European Union Water Framework Directive
EWASH	Emergency Water and Sanitation-Hygiene Group
FONPLATA	Fund for the Development of the River Plate Basin
GEF	Global Environment Facility
GIZ	Deutsche Gesellschaft für Internationale Zusammenarbeit (German Agency for International Cooperation)
GMS	Greater Mekong Sub Regions Initiative
GNF	Global Nature Fund
IBWC	International Boundary and Water Commission
ICA	International Court of Arbitration
ICJ	International Court of Justice
ICPDR	International Commission for the Protection of the Danube River
ICPR	International Commission for the Protection of the Rhine
IFAS	International Fund for Saving the Aral Sea
IJC	International Joint Commission
INPE	National Institute for Space Research, Brazil
IWRM	Integrated Water Resource Management

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JSETs	Joint Supervision and Enforcement Teams
LHWP	Lesotho Highlands Water Project
LVBC	Lake Victoria Basin Commission
MBDC	Mekong Basin Development Commission
MCM	Million Cubic Meters
MRC	Mekong River Commission
NAEHMP	National Aquatic Ecosystems Health Monitoring Programme
NCMP	National Chemical Monitoring Programme
NEMP	National Eutrophication Monitoring Programme
NGEST	Northern Gaza Emergency Sewage Treatment Project
NMMP	National Microbiological Monitoring Programme
ORASECOM	Orange Senque River Commission
OAS	Organization of American States
OAS/OSDE	Organization of American States Unit for Sustainable Development and Environment
OMVS	Organization on Pour la Mise en Valeur du fleuve Senegal (Senegal River Basin Organization)
RBC	River Basin Commission
RBO	River Basin Organization
SADC	Southern African Development Community
SDC	Swiss Agency for Development and Cooperation
SEEC	Skagit Environmental Endowment Commission
Sida	Swedish International Development Cooperation Agency
SIWI	Stockholm International Water Institute
TbEIA	Transboundary Environmental Impact Assessment
TNMN	Trans National Monitoring Network
UN	United Nations
UNDP	United Nations Development Programme
UNECE	United Nations Economic Commission for Europe
UNEP	United Nations Environment Programme
USA	United States of America
USAID	United States Agency for International Development -
USGS	U.S. Geological Survey
WWF	World Wide Fund for Nature
ZAMCOM	Zambezi Watercourse Commission
ZAMWIS	Zambezi Water Information System

# PART ONE



## Chapter 1 : Global Overview

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### INTRODUCTION

It is a strange coincidence. Out of the 148 countries sharing water resources, 37 do not engage in cooperation for the management of water resources or if they do so, they confine their cooperation to the technical level. The same 37 countries face risk of war for reasons other than water such as land, identity, ideology or history, among others.

Among these 37 countries, some have different approaches to their various neighbours. They have peaceful relationship with the neighbouring countries with which they engage in active water cooperation. They face risk of war with the neighbouring countries with which they do not engage in active water cooperation.

The correlation between the degree of cooperation in water and general atmosphere of peace and friendship between any two or more countries is strong. It is evident all over the world and over a period of time. Water is not only about development and health. Water is also about security of people and nations.



**Any two  
countries  
engaged in  
ACTIVE  
WATER  
COOPERATION**

## 1. WATER AND WAR EQUATION

---

**DO NOT  
GO TO WAR  
for any reason  
whatsoever.**

Active water cooperation means commitment of riparian countries to most of the following activities, or more, where such commitment is translated into action programmes implemented with agreed time frames or on an on-going basis

- Joint management of the water body with decision making authority on water allocation and resource management submitted to a river basin organization
- Joint investment programme and joint decision making on allocation of financial resources pertaining to projects to accrue benefits from the river or lake
- Joint management of flood control
- Coordination of water quality and reduction of pollutants to harmonise quality between countries
- Joint programme of action for environmental protection of water body with deadlines which are implemented
- Consultation between riparian countries on construction of dams or reservoirs with data exchange accepted by all countries or joint construction and management of dams
- Joint management of water flows in all their aspects.

Active water cooperation does not mean mere signing of a treaty for allocation of water or for data exchange or for establishing a river basin organisation unless there is verifiable joint management of water resources as delineated above.

For instance, the following DO NOT meet the criteria of active water cooperation

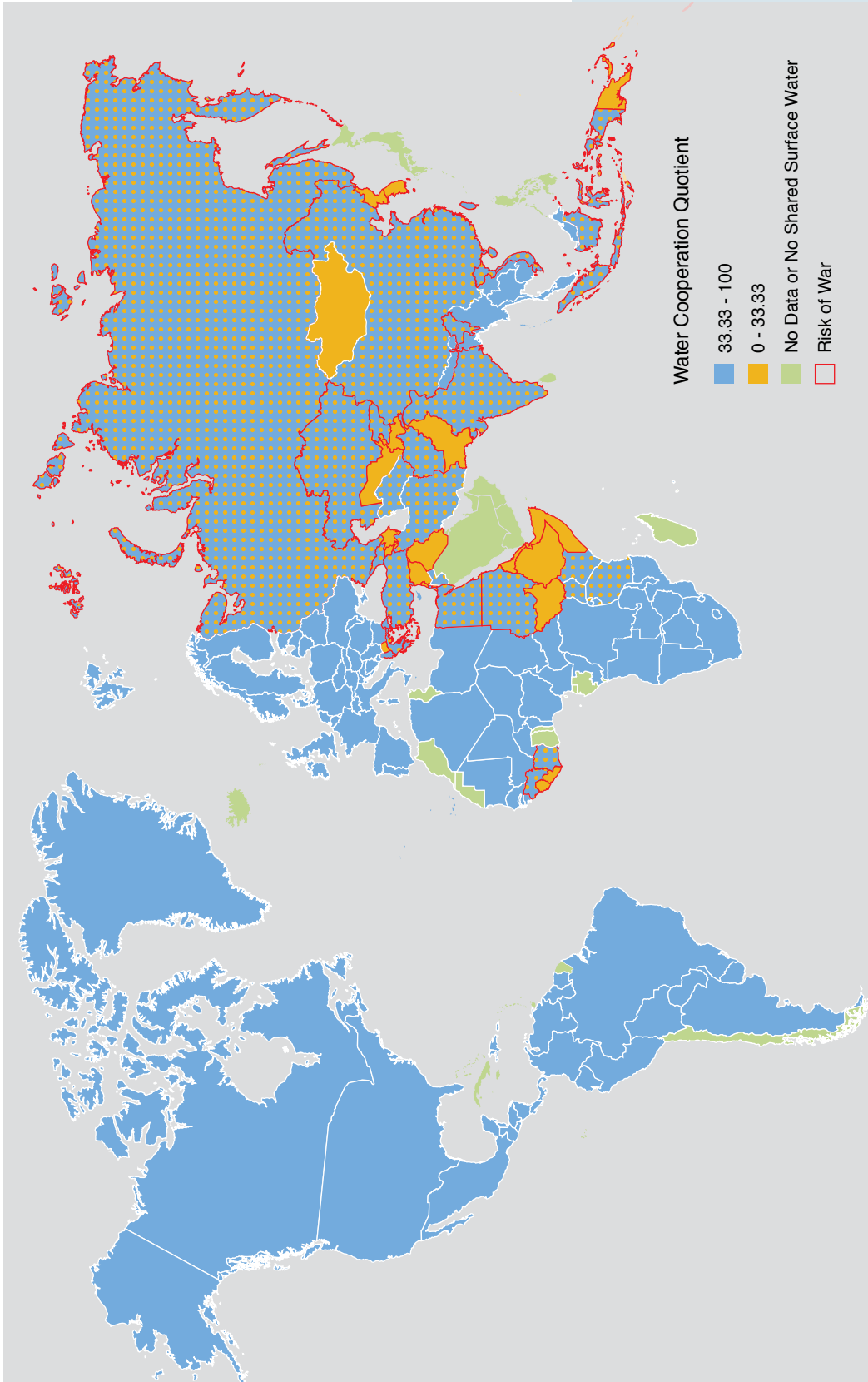
- Indus Water Commission between India, Pakistan, since it is only about allocation of rivers without any joint management elements
- Aral Sea Basin Commission (International Commission for Water Coordination of Central Asia) which is only a treaty to establish a river basin organisation but without any operational joint management or decision making with regards to environmental protection, dam, quality coordination or any other significant aspects
- Nile Basin Initiative (in parts) as it functions as per the above criteria between White Nile basin countries but not between Blue Nile basin countries.

War means military confrontation or armed hostilities of any kind or direct or indirect involvement in cross-border terrorism or a risk of any such events that could result in significant loss of human life in the short or medium term, irrespective of temporary calm.

Reason means any reason whatsoever which may or may not be related to water and may include land, ideology, rivalry for supremacy, among others.



WORLD



## MIDDLE EAST

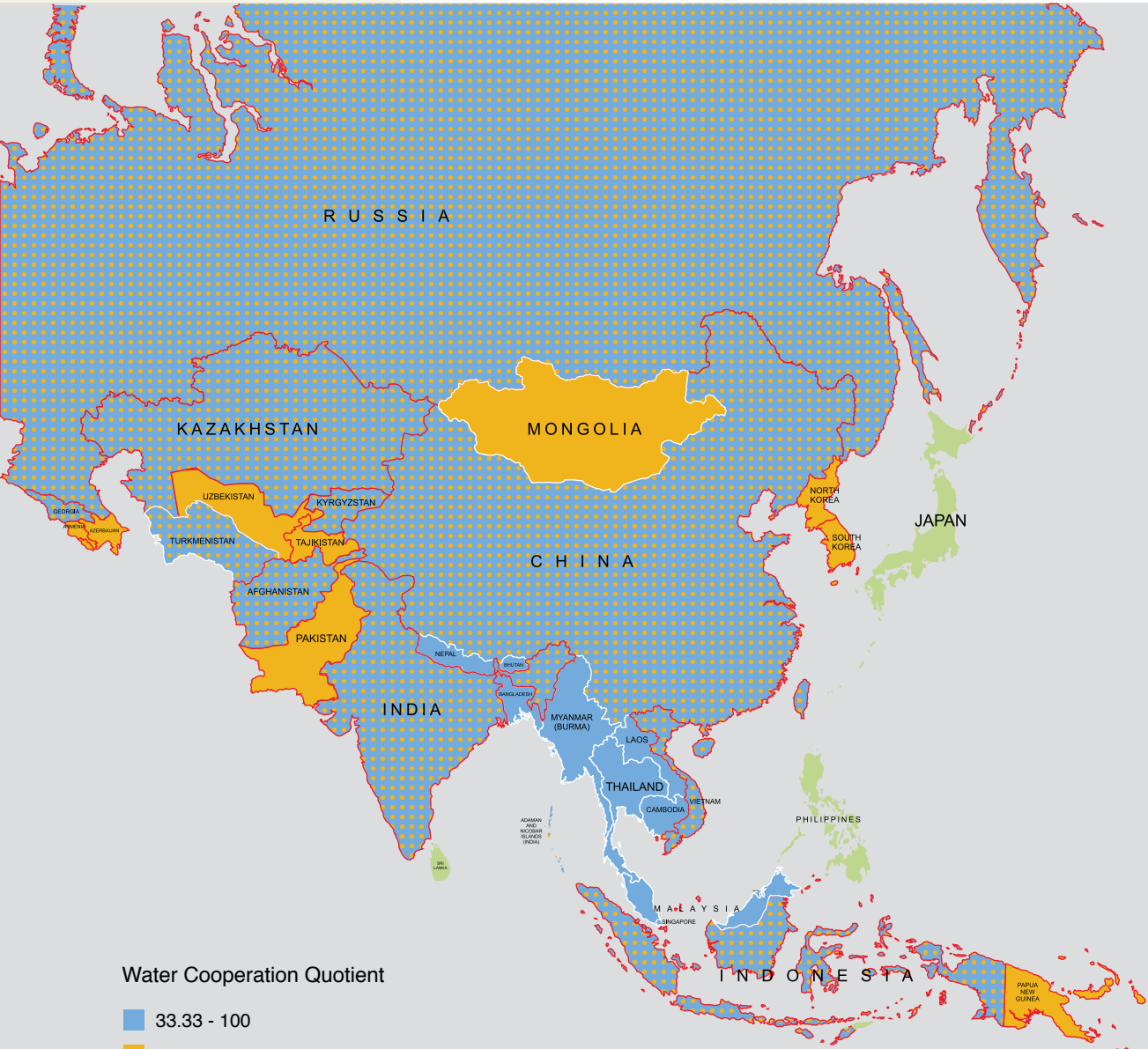


## Middle East - Asia

Country	Cooperation Details	Active Water Cooperation
Turkey	Bilateral Commission bet Turkey-Georgia, Joint Technical Committee bet Iraq-Syria-Turkey on ET Basin	80.08 with Georgia, 1.82 with ET Basin, 0.00 with Greece
Lebanon	Bilateral agreement between Lebanon and Syria	7.28 with Syria, 0.00 with Israel
Syria	Bilateral agreement between Lebanon and Syria, Yarmuk coop between Jordan-Syria, Joint Technical Committee bet Iraq-Syria-Turkey on ET Basin	7.28 with Lebanon and Jordan, 1.82 with ET Basin, 0.00 with Israel
Israel	Bilateral treaty bet Israel and Jordan, JWC bet Israel-PA	60.06 with Jordan, 10.92 with Palestine, 0.00 with Syria and Lebanon
Jordan	Bilateral treaty bet Israel and Jordan, Yarmuk coop between Jordan-Syria	60.06 with Israel, 7.28 with Syria
Palestine	JWC bet Israel-PA	10.92 with Israel
Iran	Helmand Delta Commission, Iran-Turkmenistan (Attrak), Shatt Al Arab, Astara Chay Basin	58.24 with Afghanistan, 49.14 with Turkmenistan, 1.82 with Iraq, 0.00 with Azerbaijan
Iraq	Joint Technical Committee bet Iraq-Syria-Turkey on ET Basin, Shatt Al Arab	1.82 with ET Basin, 1.82 with Iran
Afghanistan	Helmand Delta Commission	58.24 with Helmand (Iran), 0.00 with Pakistan
Turkmenistan	ICWC, Iran-Turkmenistan (Attrak)	49.14 with Iran, 27.30 with ICWC
Uzbekistan	ICWC	27.30
Kyrgyzstan	ICWC, bilateral coop between Kazakhstan-Kyrgyzstan	61.88 with Kazakhstan, 27.30 with ICWC
Tajikistan	ICWC	27.30
Kazakhstan	ICWC, bilateral coop between Kazakhstan-Kyrgyzstan, Kazakh-China Commission, Kazakh-Russia Commission (Ob-Irtysh)	65.52 with Russia, 61.88 with Kyrgyzstan, 43.68 with China, 27.30 with ICWC
Pakistan	India-Pakistan Indus Commission	23.66 with India, 0.00 with Afghanistan
India	India-Pakistan Indus Commission, bilateral cooperation between India-China, bilateral cooperation between India-Bangladesh, bilateral cooperation between India-Bhutan, bilateral cooperation between India-Nepal, bilateral cooperation between India-Myanmar	70.98 with Myanmar, 67.34 with Bhutan, 60.06 with Bangladesh, 56.42 with Nepal, 23.66 with Pakistan, 12.74 with China
Nepal	Bilateral cooperation between India-Nepal	56.42
Bangladesh	Bilateral cooperation between India-Bangladesh, Bilateral cooperation between Myanmar and Bangladesh	60.06 with India, NA with Myanmar
Bhutan	Bilateral cooperation between India-Bhutan	67.34
China	Amur Commission, Tumen Commission, bilateral cooperation between Myanmar and China; Kazakh-China Commission, bilateral cooperation between India-China	52.78 with Myanmar, 43.68 with Kazakhstan, 29.12 with Tumen, 12.74 with India, 0.00 with Vietnam
Mongolia	Amur Commission	29.12 with Tumen, NA with Amur

NA - Data not available

# ASIA



Water Cooperation Quotient

- 33.33 - 100
- 0 - 33.33
- No Data or No Shared Surface Water
- Risk of War

Country	Cooperation Details	Active Water Cooperation
Myanmar	Bilateral cooperation between Myanmar and Bangladesh; bilateral cooperation between India-Myanmar, bilateral cooperation between Myanmar-China, Asean	70.98 with India, 52.78 with China, 49.14 with Asean, NA with Bangladesh
Laos	Mekong Commission, Asean	85.54 with Mekong, 49.14 with Asean
Vietnam	Mekong Commission, Asean	85.54 with Mekong, 49.14 with Asean, 0.00 with China
Thailand	Mekong Commission, Asean	85.54 with Mekong, 49.14 with Asean
Cambodia	Mekong Commission, Asean	85.54 with Mekong, 49.14 with Asean
Malaysia	Bilateral agreement bet Malaysia and Singapore, Asean	81.90 with Singapore, 49.14 with Asean
Brunei	Bilateral cooperation bet Brunei, Singapore, Asean	67.34 with Singapore, 49.14 with Asean
Singapore	Bilateral agreement bet Malaysia and Singapore, Bilateral cooperation bet Brunei, Singapore; Asean	81.90 with Malaysia, 67.34 with Brunei, 49.14 with Asean
Indonesia	Asean	49.14 with Asean, 0.00 with Papua NG
Papua New Guinea		0.00 with Indonesia
North Korea	Tumen Commission	29.12 with Tumen, 0.00 with South Korea
South Korea		0.00 with North Korea

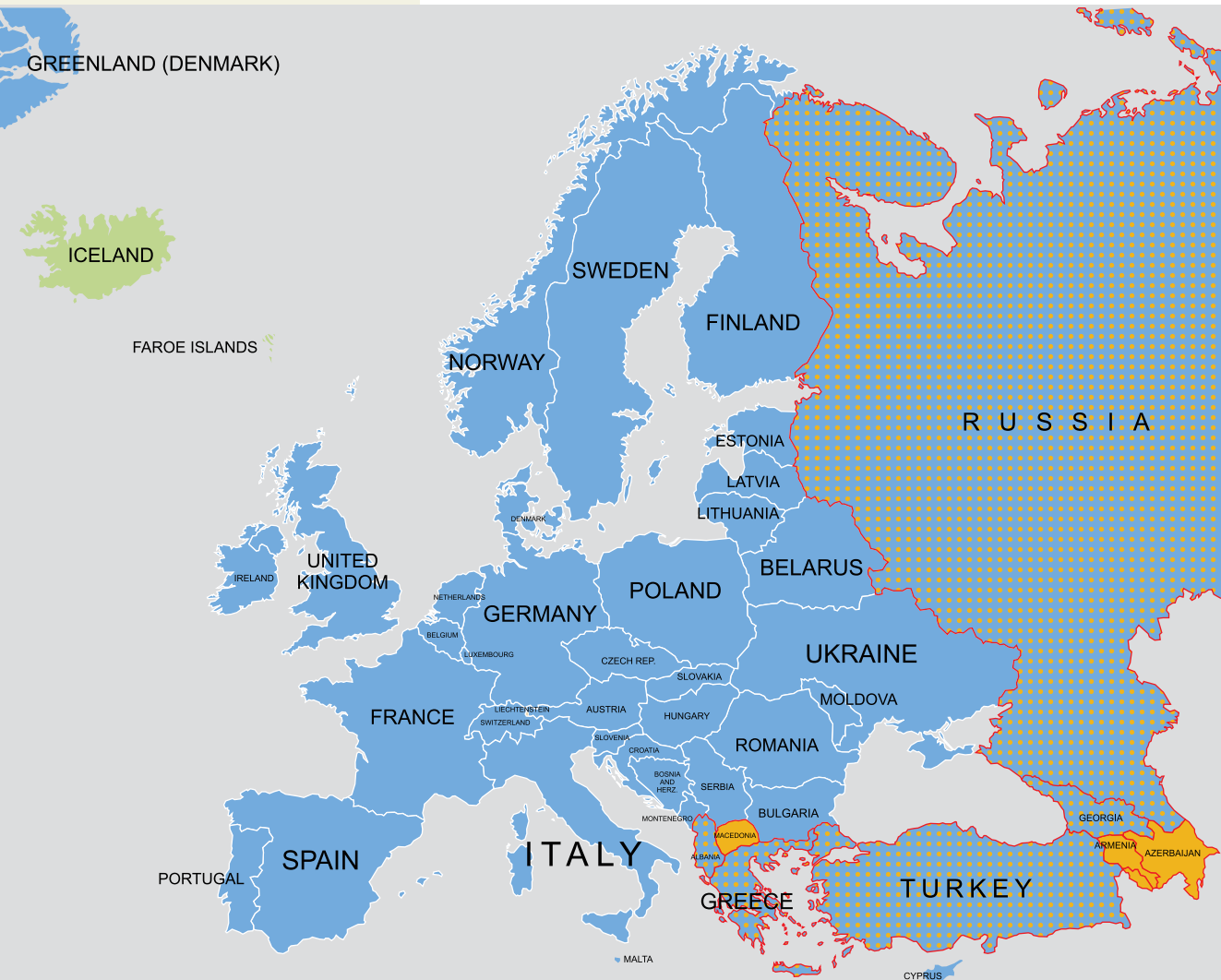
*GCC not included since no shared surface waters: Saudi Arabia, Yemen, Kuwait, Qatar, UAE, Oman*

*Also not included: Japan, Australia, Maldives, New Zealand since no shared surface water*

## Europe

Country	Cooperation Details	Active Water Cooperation
Portugal	EUWFD	94.64
Spain	EUWFD	94.64
France	EUWFD, Rhine Commission, Rhone river cooperation between France, Switzerland, Italy	100.00 with Rhine, 94.64 with EU, 94.64 with Rhone
U.K.	EUWFD	94.64
Ireland	EUWFD	94.64
Norway	Bilateral or trilateral commissions between Norway-Sweden-Finland	74.62
Sweden	EUWFD, Bilateral or trilateral commissions between Norway-Sweden-Finland	94.64 with EU, 74.62 with Norway
Finland	EUWFD, Bilateral or trilateral commissions between Norway-Sweden-Finland, bilateral river commission bet Finland and Russia	100.00 with Russia, 94.64 with EU, 74.62 with Norway
Denmark	EUWFD	94.64
Netherland	EUWFD, Rhine Commission	100.00 with Rhine, 94.64 with EU
Germany	EUWFD, Rhine Commission, Danube Commission, Oder cooperation between Germany, Poland, Czech, Slovakia	100.00 with Rhine, 94.64 with EU, Oder and Danube

## EUROPE



## Water Cooperation Quotient

- 33.33 - 100
- 0 - 33.33
- No Data or No Shared Surface Water
- Risk of War

Country	Cooperation Details	Active Water Cooperation
Belgium	EUWFD, Rhine Commission	100.00 with Rhine, 94.64 with EU
Luxembourg	EUWFD, Rhine Commission	100.00 with Rhine, 94.64 with EU
Switzerland	Rhine Commission, Danube Commission, Rhone river cooperation between France, Switzerland, Italy	100.00 with Rhine, 94.64 with Danube and Rhone
Italy	EUWFD, Rhine Commission, Danube Commission, Rhone river cooperation between France, Switzerland, Italy	94.64 with Danube, Rhone and EU, 100.00 with Rhine
Austria	EUWFD, Rhine Commission, Danube Commission	100.00 with Rhine, 94.64 with Danube, and EU
Malta	EUWFD	94.64
Poland	EUWFD, Danube Commission, Oder cooperation between Germany, Poland, Czech, Slovakia	94.64 with EU, Oder and Danube
Czech Republic	EUWFD, Danube Commission, Oder cooperation between Germany, Poland, Czech, Slovakia	94.64 with EU, Oder and Danube
Slovakia	EUWFD, Danube Commission, Oder cooperation between Germany, Poland, Czech, Slovakia	94.64 with EU, Oder and Danube
Slovenia	EUWFD, Danube Commission	94.64 with EU, Oder and Danube
Hungary	EUWFD, Danube Commission	94.64 with EU, and Danube
Croatia	Danube Commission	94.64
Bosnia-Herzegovina	Danube Commission	94.64
Serbia (Yugoslavia)	Danube Commission	94.64
Montenegro	Danube Commission	94.64
Albania	Danube Commission	94.64 with Danube, 0.00 with Macedonia
Macedonia, FYR		0.00 with Albania
Bulgaria	EUWFD, Danube Commission,	94.64 with EU and Danube
Romania	EUWFD, Danube Commission,	94.64, 94.64
Moldova	Danube Commission, bilateral agreements bet Ukraine and Moldova	94.64 with Danube, 65.52 with Ukraine
Belarus	Dniper river agreement bet Belarus and Ukraine	47.32 with Ukraine
Latvia	EUWFD, bilateral agreements bet Latvia and Lithuania	100.00 bet Latvia and Lithuania, 94.64 with EU
Lithuania	EUWFD, bilateral agreements bet Latvia and Lithuania	100.00 bet Latvia and Lithuania, 94.64 with EU
Estonia	EUWFD	94.64
Armenia		0.00
Azerbaijan	Armenia, Astara Chay Basin (Iran - Azerbaijan)	0.00
Georgia	Bilateral commission Georgia-Turkey	80.08 with Turkey, 0.00 with Russia
Greece	EUWFD	94.64 with EU, 0.00 with Turkey
Cyprus	EUWFD	94.64
Ukraine	Danube Commission, bilateral agreements bet Ukraine and Moldova; Dniper river agreement bet Belarus and Ukraine	94.64 with Danube, 65.52 with Moldova, 47.32 with Belarus
Russia	bilateral river commission bet Finland and Russia, Amur Commission and Tumen Commission with Asian neighbours, Kazakh-Russia Commission (Ob-Irtysh)	100.00 with Finland, 65.52 with Kazakhstan, Belarus; 29.12 with Tumen; 0.00 with Georgia

## NORTH AMERICA



## Water Cooperation Quotient

- 33.33 - 100
- 0 - 33.33
- No Data or No Shared Surface Water
- Risk of War



## North America

Country	Cooperation Details	Active Water Cooperation
Canada	IJC between Canada and US	94.64
US	IJC between Canada and US, IBWC bet US and Mexico	94.64, 94.64
Mexico	IBWC bet US and Mexico, International Commission on Limits and Water between Mexico-Guatemala	94.64 with US, 52.78 with Guatemala
Guatemala	CAIS Action Plan for Integrated Management of Water Resources, International Commission on Limits and Water between Mexico-Guatemala, Trifinio Plan	100.00 with CAIS, 100.00 with Trifinio Plan, 52.78 with Mexico
Belize	CAIS Action Plan for Integrated Management of Water Resources	100.00
Honduras	CAIS Action Plan for Integrated Management of Water Resources, Trifinio Plan	100.00, 100.00
El Salvador	CAIS Action Plan for Integrated Management of Water Resources, Trifinio Plan	100.00
Nicaragua	CAIS Action Plan for Integrated Management of Water Resources	100.00
Costa Rica	CAIS Action Plan for Integrated Management of Water Resources	100.00
Panama	CAIS Action Plan for Integrated Management of Water Resources	100.00
Haiti	Treaty of Peace and Friendship between Haiti and Dominican Rep.	67.34
Dominican Republic	Treaty of Peace and Friendship between Haiti and Dominican Rep.	67.34



## SOUTH AMERICA



## South America

Country	Cooperation Details	Active Water Cooperation
Colombia	Amazon Treaty	100.00
Venezuela	Amazon Treaty	100.00
Guyana	Amazon Treaty	100.00
Suriname	Amazon Treaty	100.00
Ecuador	Amazon Treaty	100.00
Peru	Amazon Treaty	100.00
Brazil	Amazon Treaty, La Plata	100.00 with Amazon, 85.54 with La Plata
Paraguay	La Plata	85.54
Bolivia	Amazon Treaty, La Plata,	100.00 with Amazon, 85.54 with La Plata
Argentina	La Plata, Bi-national Commission of Economic Cooperation and Physical Integration between Argentine-Chile	85.54, NA with Chile
Chile	Bi-national Commission of Economic Cooperation and Physical Integration between Argentine-Chile	NA with Argentina, Bolivia
Uruguay	La Plata	85.54

*French Guiana is not considered since it is under French dominion and subject to EU policies.*

*NA - Data not available*



## AFRICA



## Africa

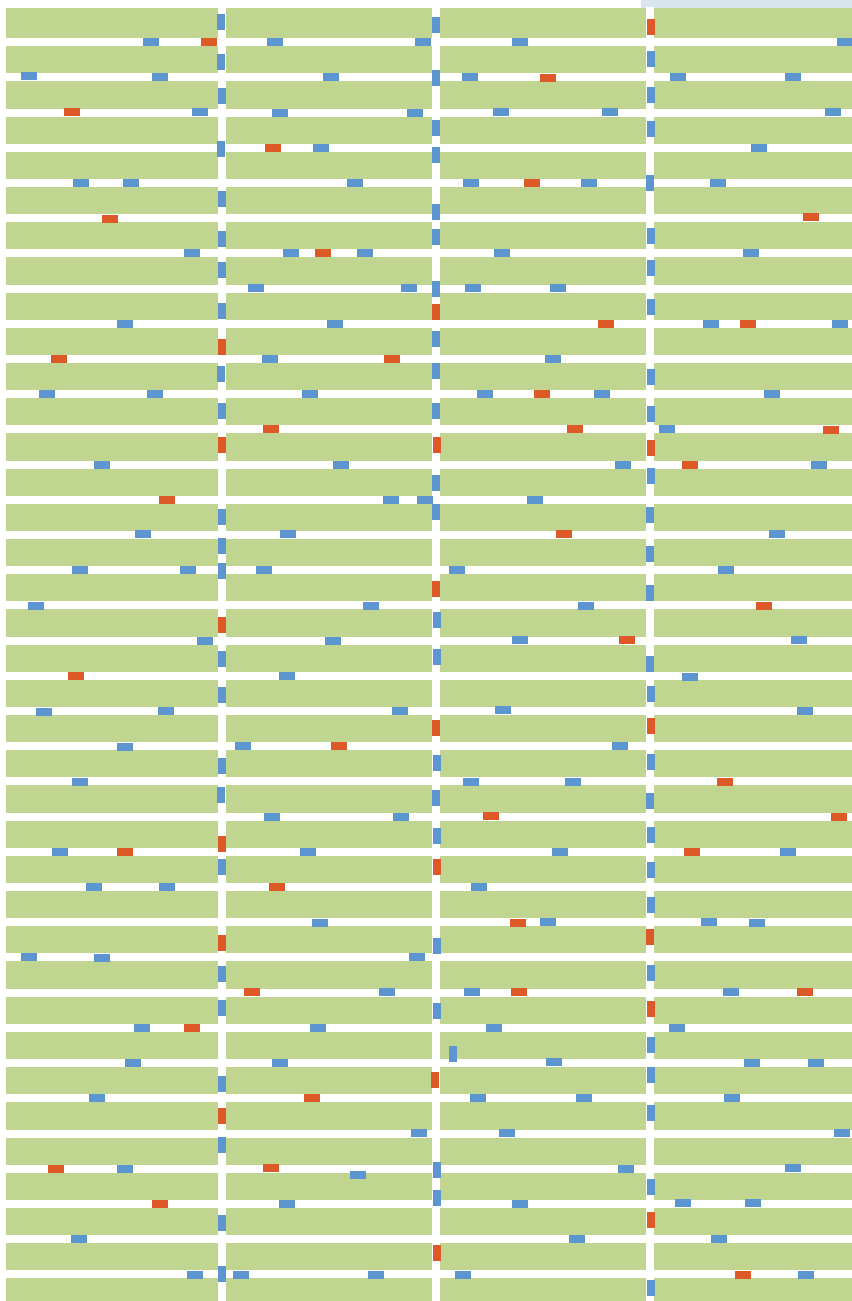
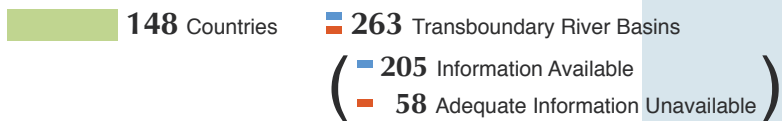
Country	Cooperation Details	Active Water Cooperation
Mauritania	OMVS	91.00
Morocco	MOC bet Algeria-Morocco	NA
Algeria	Ch, Ng, Treaty of Fraternity and Concord bet Tunisia and Algeria covering all aspects of economy including water, MOC Water bet Algeria-Morocco	43.68 with Chad, 56.42 with Niger, 0.00 with Morocco, NA with Tunisia and Morocco
Mali	OMVS, Ng, Volta Basin Authority	91.00 with OMVS, 56.42 with Niger, NA with Volta
Tunisia	Treaty of Fraternity and Concord bet Tunisia and Algeria covering all aspects of economy including water	NA with Algeria
Libya	Ch	43.68
Niger	Ch, Ng	56.42 with Niger, 43.68 with Chad
Egypt	NBI, bilateral water cooperation bet Egypt and Sudan	100.00 with Sudan, 32.76 with NBI
Chad	Ch, Ng	56.42 with Niger, 43.68 with Chad
Sudan	Ch, NBI, bilateral water cooperation bet Egypt and Sudan	100.00 with Egypt, 43.68 with Chad, 32.76 with NBI
South Sudan	NBI	32.76
Eritrea		0.00
Ethiopia	NBI	32.76 with NBI, 0.00 with Eritrea, Somalia
Djibouti		0.00
Somalia		0.00
Senegal	OMVS, Gambia OMVG	91.00 with OMVS, 54.60 with Gambia OMVG
Gambia	Gambia OMVG	54.60 with Gambia OMVG
Guinea	OMVS, Niger, Gambia OMVG, Bilateral agreement bet Guinea and Guinea Bissau, Mano River Union	91.00 with OMVS, 56.42 with Niger, 54.60 with Gambia OMVG, 20.02 with Mano, NA bet Guinea-GB
Guinea-Bissau	Bilateral agreement bet Guinea and Guinea Bissau	54.60 with Gambia OMVG, NA bet Guinea-GB
Central African Republic	Ch, Congo River Commission	43.68 with Chad, 41.68 with Congo
Sierra Leone	Mano River Union	20.02
Liberia	Mano River Union	20.02
Ivory Coast	Ng, Volta Basin Authority, Mano River Union	56.42 with Niger, 20.02 with Mano River Union, NA with Volta
Burkina Faso	Ng, Volta Basin Authority	56.42 with Niger, NA with Volta
Ghana	Volta Basin Authority	NA
Benin	Ng, Volta Basin Authority	56.42 with Niger, NA with Volta
Togo	Volta Basin Authority	NA
Nigeria	Ch, Ng	56.42 with Niger, 43.68 with Chad
Cameroon	Ch, Ng, Congo River Commission	56.42 with Niger, 43.68 with Chad, 41.68 with Congo

Country	Cooperation Details	Active Water Cooperation
Equatorial Guinea	Mbe River Agreement bet Equatorial Guinea and Gabon	NA
Gabon	Mbe River Agreement bet Equatorial Guinea and Gabon	NA
Republic of Congo (Brazzaville)	Congo River Commission	41.86
DR Congo (Zaire)	SADC, Zambezi Commission, Congo River Commission, NBI	100.00 with SADC, 69.16 with Zambezi, 41.86 with Congo, 32.76 with NBI
Uganda	LVBC, NBI	87.36 with LVBC, 32.76 with NBI
Kenya	LVBC, NBI	87.36 with LVBC, 32.76 with NBI
Burundi	LVBC, NBI	87.36 with LVBC, 32.76 with NBI
Rwanda	LVBC, NBI	87.36 with LVBC, 32.76 with NBI
Tanzania	SADC, LVBC, Zambezi Commission, NBI	100.00 with SADC, 87.36 with LVBC, 69.16 with Zambezi, 32.76 with NBI
Malawi	SADC, Zambezi Commission	100.00 with SADC, 69.16 with Zambezi
Mauritius	SADC	100.00
Mozambique	SADC, Zambezi Commission	100.00 with SADC, 69.16 with Zambezi
Angola	SADC, Zambezi Commission	100.00 with SADC, 69.16 with Zambezi
Zambia	SADC, Zambezi Commission	100.00 with SADC, 69.16 with Zambezi
Zimbabwe	SADC, Zambezi Commission	100.00 with SADC, 69.16 with Zambezi
Namibia	SADC, Zambezi Commission, ORASECOM	100.00 with SADC, 69.16 with Zambezi
Botswana	SADC, Zambezi Commission	100.00 with SADC, 69.16 with Zambezi
Swaziland	SADC	100.00
Lesotho	SADC	100.00 with SADC
South Africa	SADC	100.00 with SADC

NA - Data not available

MOC - Memorandum of Cooperation

## Scope of the Study



## 2. WATER COOPERATION QUOTIENT

Central American Action Plan for Integrated Management of Water Resources	100
Trifinio Plan	100
Amazon Cooperation Treaty Organization (ACTO)	100
International Commission for the Protection of the Rhine (ICPR)	100
Finnish- Russian Joint Commission on the Utilization of Frontier Waters	100
Latvia-Lithuania Cross-Border Cooperation Programme	100
1959 Nile Waters Agreement (Egypt - Sudan)	100
South African Development Community (SADC)	100
International Joint Commission (US - Canada)	94.64
International Boundary and Water Commission (US - Mexico)	94.64
European Union Water Framework Directive (EUWFD)	94.64
International Commission for the Protection of Lake Geneva - Rhone (CIPEL)	94.64
International Commission for the Protection of the River Danube (ICPDR)	94.64
International Commission for the Protection of the Oder River against Pollution (ICPOAP)	94.64
Organisation pour la Mise en Valeur du fleuve Sénégal (OMVS)	91.00
Lake Victoria Basin Commission (LVBC)	87.36
La Plata Intergovernmental Co-ordinating Committee (CIC)	85.54
Mekong River Commission (MRC)	85.54
Bilateral agreement b/w Malaysia & Singapore	81.9
Joint Boundary Water Commission (Turkey - Georgia)	80.08
Malaysia and Thailand Collaboration Project	80.08
Finnish-Norwegian Transboundary Water Commission	74.62
Finnish- Swedish Frontier River Commission	74.62
Bilateral between India and Myanmar	70.98
Zambezi Watercourse Commission (ZAMCOM)	69.16
Bilateral coop b/w India- Bhutan	67.34
Bilateral cooperation b/w Brunei & Singapore	67.34
Treaty of Peace, Friendship and Arbitration (Haiti - Dom. Republic)	67.34
Bilateral between Russia and Kazakhstan (Ob-Irtysh)	65.52
Agreement between Moldova and Ukraine on the Joint Use and Protection of the Cross-Border Waters	65.52
Commission between Kazakhstan and Kyrgyz Republic for the Rivers Chu and Talas	61.88
Bilateral treaty b/w Israel & Jordan	60.06
Joint River Commission b/w India and Bangladesh	60.06



Helmand River Delta Commission	58.24
Niger Basin Authority (NBA)	56.42
Mahakali River Commission	56.42
Gambia River Basin Development Organization (OMVG)	54.6
The International Commission on Limits and Waters between Mexico and Guatemala (CILA)	52.78
Salween River Strategic Cooperation Framework Agreement	52.78
Bilateral between Iran and Turkmenistan (Atrak)	49.14
The Association of Southeast Asian Nations (ASEAN)	49.14
International Dnieper Basin Council	47.32
Commission on Use and Protection of Transboundary Rivers	43.68
Lake Chad Basin Commission	43.68
International Commission of Congo-Oubangui-Sangha (CICOS)	41.86
Nile Basin Initiative (NBI)	32.76
The Greater Tumen Initiative (GTI)	29.12
Interstate Commission for Water Coordination of Central Asia (ICWC)	27.3
Permanent Indus Commission	23.66
Mano River Union (MRU)	20.02
Bilateral cooperation on River Brahmaputra	12.74
Israel and Palestine Aquifers	10.92
Bilateral cooperation between Lebanon and Syria (El Kabir and Orontes)	7.28
Bilateral cooperation between Jordan-Syria (Yarmuk)	7.28
Cooperation amongst Iraq-Turkey-Iran-Syria- (Tigris-Euphrates/Shatt Al Arab)	1.82
Maritsa River Basin	0
Trilateral cooperation between Jordan- Syria- Lebanon	0
Astara Chay River Basin	0
Juba-Shibelli River Basin	0
Wadi Al Izziyah	0
Terek	0
Awash	0
Volta Basin Authority was set up in 2011	~
Struma River Basin - Joint group between Greece and Bulgaria was created only in 2011	~
Daoura/Dra/Guir/Oude bon naïma/Tafna River Basins - Memorandum of cooperation in 2011	~



## The Water Cooperation Quotient was calculated using the following parameters:

- 1 **Agreement:** if there is a formal agreement for cooperation
- 2 **Commission:** if the cooperation has been institutionalised in the form of a permanent body such as a Commission or otherwise
- 3 **Ministerial Meetings:** if the cooperation is a matter of priority at the ministerial level as reflected in ministerial meetings as and when required.
- 4 **Technical Projects:** if there are joint projects at the technical level.
- 5 **Environmental Protection and Quality Control:** if the riparian countries work together for environmental monitoring or quality control of the shared water body.
- 6 **Joint Monitoring of Water Flows:** if the riparian countries jointly monitor water flows with transparent verification mechanism and harmonised protocols for interpretation of data.
- 7 **Floods, Dams and Reservoir:** if the riparian countries collaborate actively and transparently in issues related to flood control, dams and reservoirs in border areas in a way that takes into interest of all relevant riparian countries and not merely the host country of the concerned project.
- 8 **High Political Commitment:** if there is a commitment at the highest political level such as Heads of Government, Parliaments or other institutions to the trans-boundary cooperation mechanism.
- 9 **Integration into Economic Cooperation:** whether cooperation in water resources is integrated with regional economic cooperation.
- 10 **Actual Functioning of the Commission or Trans-boundary Water Cooperation Mechanism:** if information available from open sources indicated whether the concerned cooperation mechanism is functioning efficiently and with dedication of the participation countries.

*The weightage is provided in ascending order with 1 for Agreement and 10 for Actual Functioning of the Commission.*

There is no reliable information available on the status of cooperation in the following basins. As a result, they had to be excluded from the evaluation process for the purpose of calculating the Water Cooperation Quotient.

- Aviles, Aysen, Baker, Carmen Silva/Chico, Comau, Cullen, Gallegos-Chico, Lake Fagnano, Palena, Pascua, Puelo, Rio-Grande, San Martin, Serrano, Valdivia, Yelcho, Zapaleri, Argentina-Chile - Binational Commission of Economical Cooperation and Physical Integration
- Amur River Coordination Committee
- Neman River Basin
- Drina River Basin - Informal set up between Regional Environmental Centre for Central and Eastern Europe (REC) and municipalities
- A draft of a trilateral Agreement on Cooperation in the Field of Use and Protection of Water Resources in Zapadnaya Dvina/Daugava River Basin
- Medjerda River Basin - Treaty of Fraternity and Concord between Tunisia and Algeria
- Vijose River Basin - Greek Albanian Permanent Commission on Transboundary Freshwater Resources setup in 2005.
- Cancosa/Lauca River Basin
- Murgab River Basin
- Fly/Sepik/Tami/Tjeroaka-Wanggoe River Basins - Fly River Provincial Boundaries Commission, 1978
- Harirud Dostluk Commission
- Veleka and Rezovska River Basins - Agreement Between the People's Republic of Bulgaria and the Republic of Turkey Concerning Co-operation in the Use of the Waters of Rivers Flowing Through the Territory of Both Countries
- Pu Lun To
- Tarim
- Benito/Ntem
- Mbe
- Oueme
- Kuru/Araks
- Samur
- Sulak

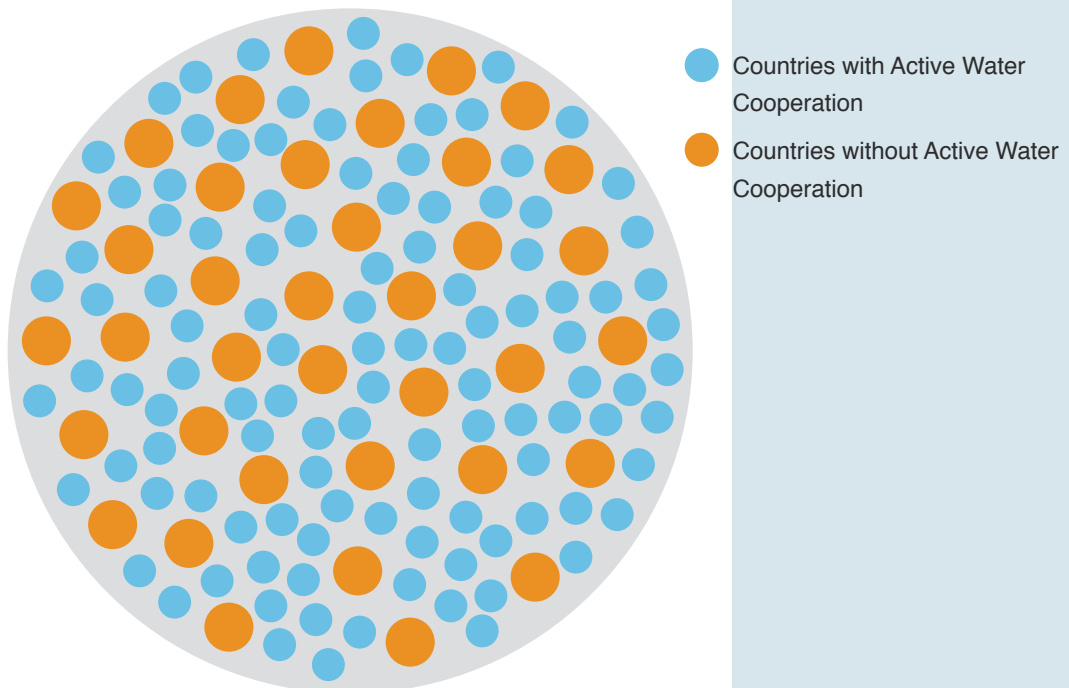


- Lake Prespa
- Narva River Basin
- Parnu
- Prohladnaja
- Salaca
- Vardar
- Vistula/Wista
- Grijalva
- Jurado
- Chiloango (Congo, Democratic Republic of (Kinshasa), Angola, Congo, Republic of the Congo (Brazzaville))
- Atui
- Nyanga
- Ogooue
- Ili/Kunes He

### 3. POPULATION AT RISK

Out of **148** countries sharing water resources,  
**37** do not engage in active water cooperation.

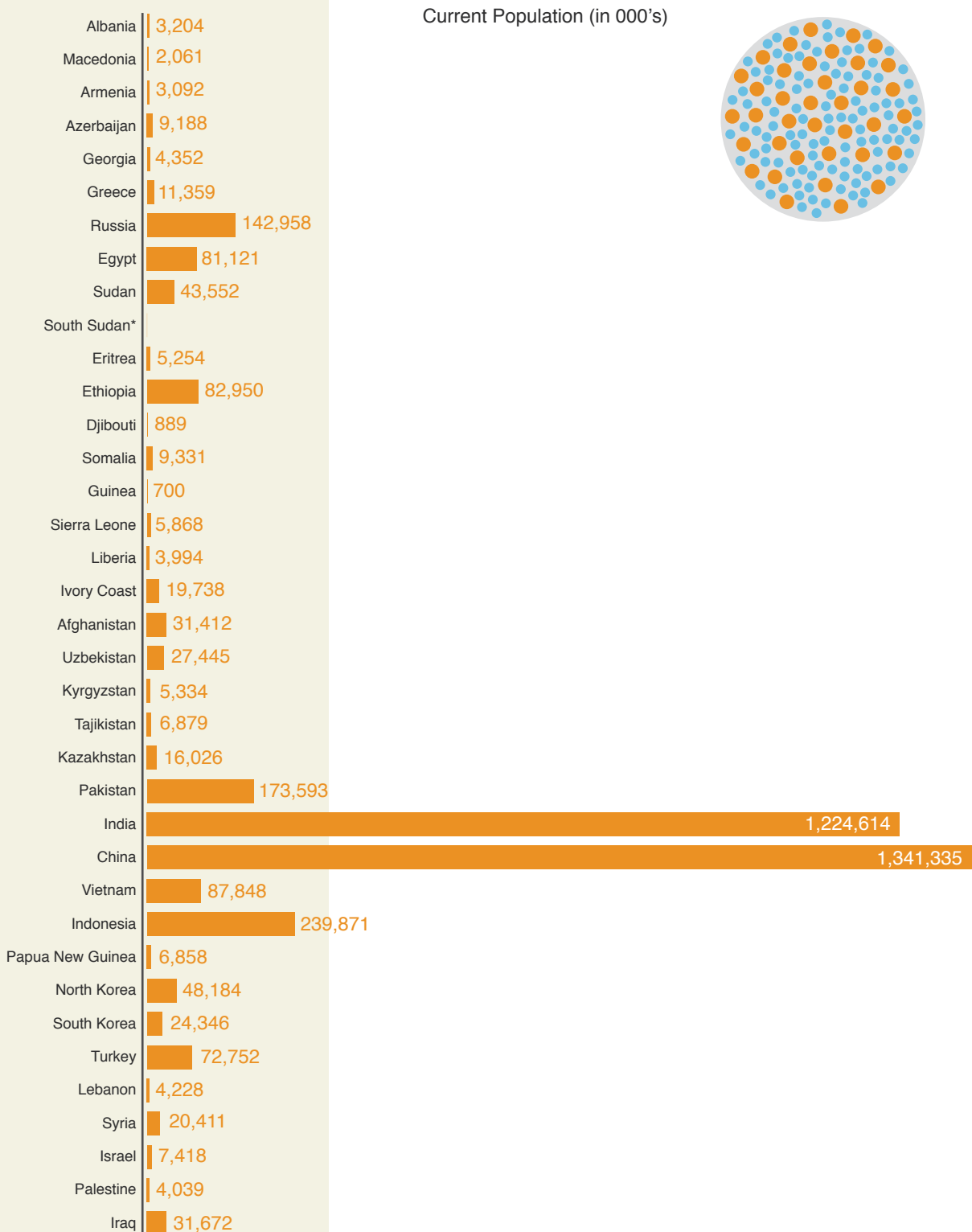
Almost a fourth of the community of nations misses optimum benefits of cooperation in water resources and exposes its population to insecurity in its relations with its neighbours. Any two or more countries of these 37 countries face a risk of war in future.



More people live in the countries **NOT** engaged in active water cooperation, and at risk of war, than those living in the countries engaged in active water cooperation and enjoying security and peace with their neighbours.



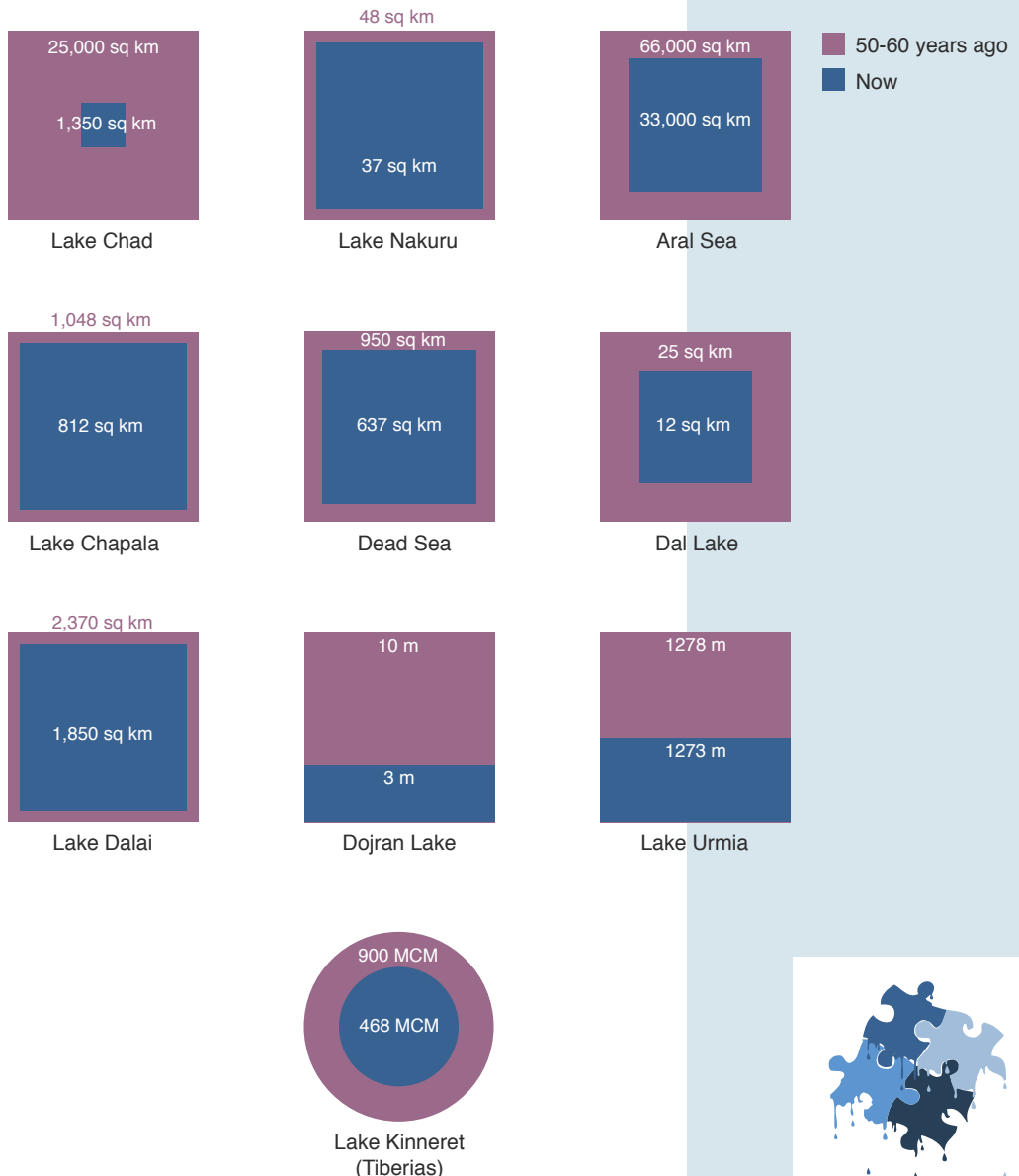
## POPULATION OF COUNTRIES AT RISK OF WAR



Source: "World Population Prospects, the 2010 Revision." United Nations, Department of Economic and Social Affairs, Population Division, Population Estimates and Projections Section. [http://esa.un.org/unpd/wpp/Sorting-Tables/tab-sorting\\_population.htm](http://esa.un.org/unpd/wpp/Sorting-Tables/tab-sorting_population.htm)

## 4. DISAPPEARING LAKES

When riparian countries do not cooperate with full dedication to the trans-boundary cooperation principles or do not pursue best governance practices for the management of internal or trans-boundary lakes, water bodies suffer. It is reflected in declining surface area or deepening levels of lakes over the last 50-60 years in many parts of the world. It is the same problem with rivers.



## 5. TO COOPERATE OR TO COMPLAIN?

Trans-boundary water relations are difficult. It is particularly possible for the countries adversely placed in a basin or a hydro-political region to detect injustice or unfairness. It is therefore natural for them to complain. But does mere complaining solve their problem? How are some countries using cooperation effectively and innovatively to overcome their difficulties? There are examples in almost every continent.



**Singapore:** With no natural water resources of its own, almost all of Singapore's water came from Malaysia at the time of independence in 1965. Following failed negotiations over increased water rates, Singapore decided to achieve self-sufficiency through its four taps strategy: sourcing water from rainwater, recycling, desalination, and imports. With new water reservoirs, desalination and recycling plants, it has reduced its dependence on Malaysia to about 50 per cent and thus averted potential conflict in the future.

**South Africa:** A downstream but powerful state, South Africa has used its economic position to collaborate with Lesotho, a lesser developed economy with abundant water resources. The Lesotho Highlands Water Project ensures that South Africa has greater access to the shared river to fulfil their water demand, in exchange for aiding infrastructure development in Lesotho. By building dams under the project, Lesotho is also getting sustained hydropower for the country, which is ultimately improving their economic output.







**Argentina:** Recognizing the shared resources between the countries and the need to co-operate and take joint actions for the sustainable development, Argentina, a downstream country, in 1966 paved the way for regional co-operation through the creation of Intergovernmental Coordinating Committee of the La Plata Basin Countries (CIC). The 1969 La Plata Basin treaty includes trans-boundary co-operation of Argentina, Bolivia, Brazil, Paraguay and Uruguay on the management of the world's fifth largest basin with Parana, Paraguay and Uruguay rivers.



**Senegal:** Senegal, a newly independent country in the 1960s and under developed economy, soon realized the benefits of co-operation to resolve its internal problems of agriculture and drinking water supply. Prior to joining the OMVS, droughts and floods adversely affected agriculture production but with the joint construction of the Manantali dam, irrigation along the dam in Senegal has widely increased in the last 3 decades, and now an estimated 90 per cent of the rice is harvested here. The Diama dam which halts salt water intrusion, is also helping Senegal to achieve its Millennium Development Goal on drinking water supply. The dam provides water for Lake Guiers, which in turn supplies Dakar and Thies.



**The Netherlands:** Following extreme floods in 1993/95, the province of Gelderland in The Netherlands in 1997 approached the German state of North-Rhine Westphalia to cooperate on flood control in the border area. In the Rhine river basin, Germany is an upstream country to the downstream Netherlands where 2/3rd of its land area is flood prone. The Dutch-German Working Group on High Water was formed for 'communication and research' to improve the flood protection at the Lower Rhine ('NiederRhein'). The group changed the flood control strategy from enforcing defence systems to 'Room for the River' policy which is now also included in the Rhine River Commission's 'Action Plan on Floods'.



## Chapter 2 : Middle East Overview

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### INTRODUCTION

The pattern of strong correlation between water cooperation and peace, or absence of cooperation and risk of war, visible all over the world is most conspicuous in the Middle East. Turkey has water cooperation agreement with Georgia. It enjoys a constructive and friendly relationship with that country. It does not have water cooperation agreements with Greece, Syria, and Iraq. It faces risk of wars and tension with these countries. Turkey enjoyed cordial relationship with Israel until 2009. It was negotiating a water cooperation agreement with that country until then.

Israel and Jordan have a water cooperation agreement, which was upgraded in 2013 to enable higher outflow of water from Lake Tiberias to the Lower Jordan River. The two countries also have relative peace by regional standards. Israel does not have water cooperation agreements with Lebanon and Syria. There is often speculation of war with these countries.

The absence of cooperation in the sharing and management of water resources in the Middle East has affected security of people, nations and nature in the Middle East. The Dead Sea is shrinking and may die by the end of this century. The disappearance of a natural wonder will be a loss for the entire region and indeed for humanity. Barada River which has fostered the growth of civilization making Damascus one of the most ancient cities to survive for over 3000 years is diminishing at a fast pace. If the river disappears altogether, at risk would be a cradle of civilization.

Cooperation in water is not merely about water. It is about security of people, nations and the civilization.



## 1. HISTORY OF WATER COOPERATION

- Treaty is being complied by parties
- Treaty is not being complied by parties

### Jordan River

### Lebanon, Syria, Israel, West Bank, Jordan

- 1953 ● Syria, Jordan | Utilization of Yarmuk waters
- 1987 ● Syria, Jordan | Utilization of Yarmuk waters - construction of Wahdah dam
- 1994 ● Israel, Jordan | Treaty of Peace - water quantity

### Tigris-Euphrates/Shatt al Arab

### Turkey, Syria, Iraq, Iran

- 1955 ● Turkey, Iran | Sharing of Sarisu and Karasu River
- 1975 ● Iran, Iraq | Use of frontier watercourses
- 1987 ● Syria, Turkey | Release of stipulated amounts of water
- 2009 ● Turkey, Iraq | Cooperation on water (MoU)

### Asi/Orontes

### Lebanon, Syria, Turkey

- 1994 ● Lebanon, Syria | Distribution of water of Al-Asi River
- 2009 ● Syria, Turkey | Utilization of water, combating drought (MoU)

### An Nahr Al Kabir

### Syria, Lebanon

- 2002 ● Syria, Lebanon | Sharing of the Great Southern River Basin water, Building joint dam

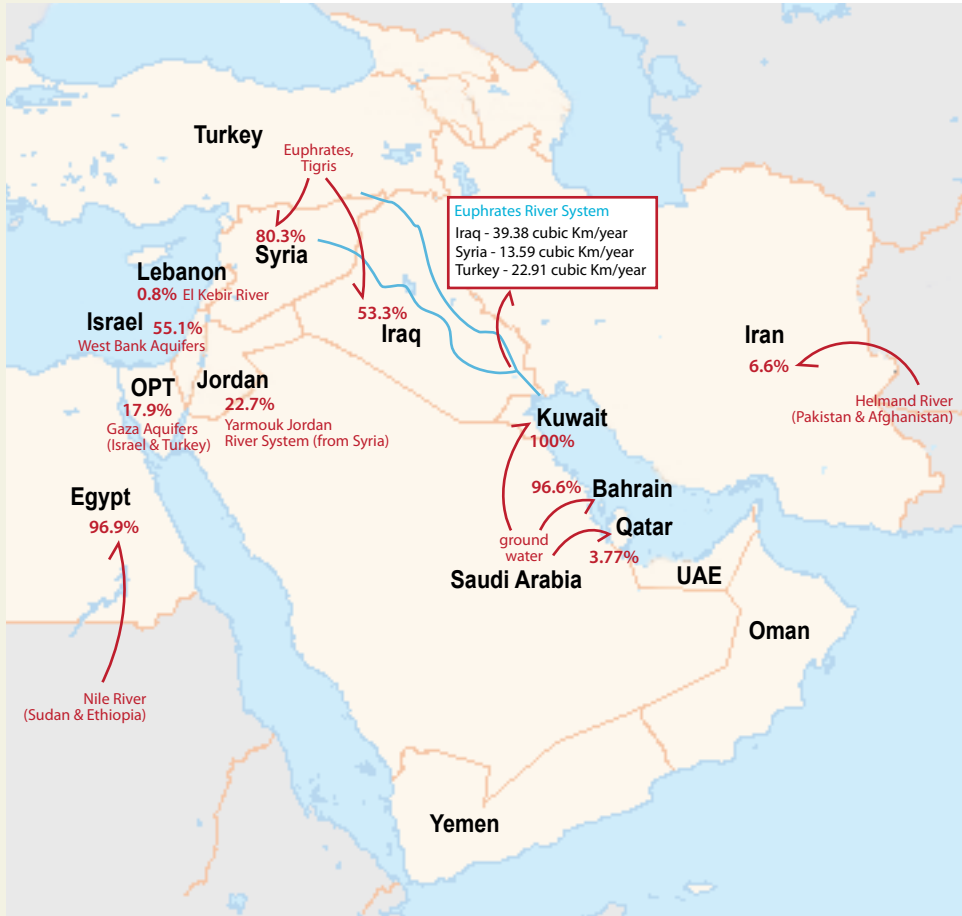
### Mountain and Coastal Aquifer

### Israel, Palestine Territories

- 1995 ● Israel, Palestine Authority | Utilization of water

The quadrilateral economic cooperation agreements together have created what Yaraub Badr, the then Transportation Minister of Syria, has described as “the step towards a union of the Middle East, similar to the European Union, since everything started with economic cooperation in Europe”. (March 2011)

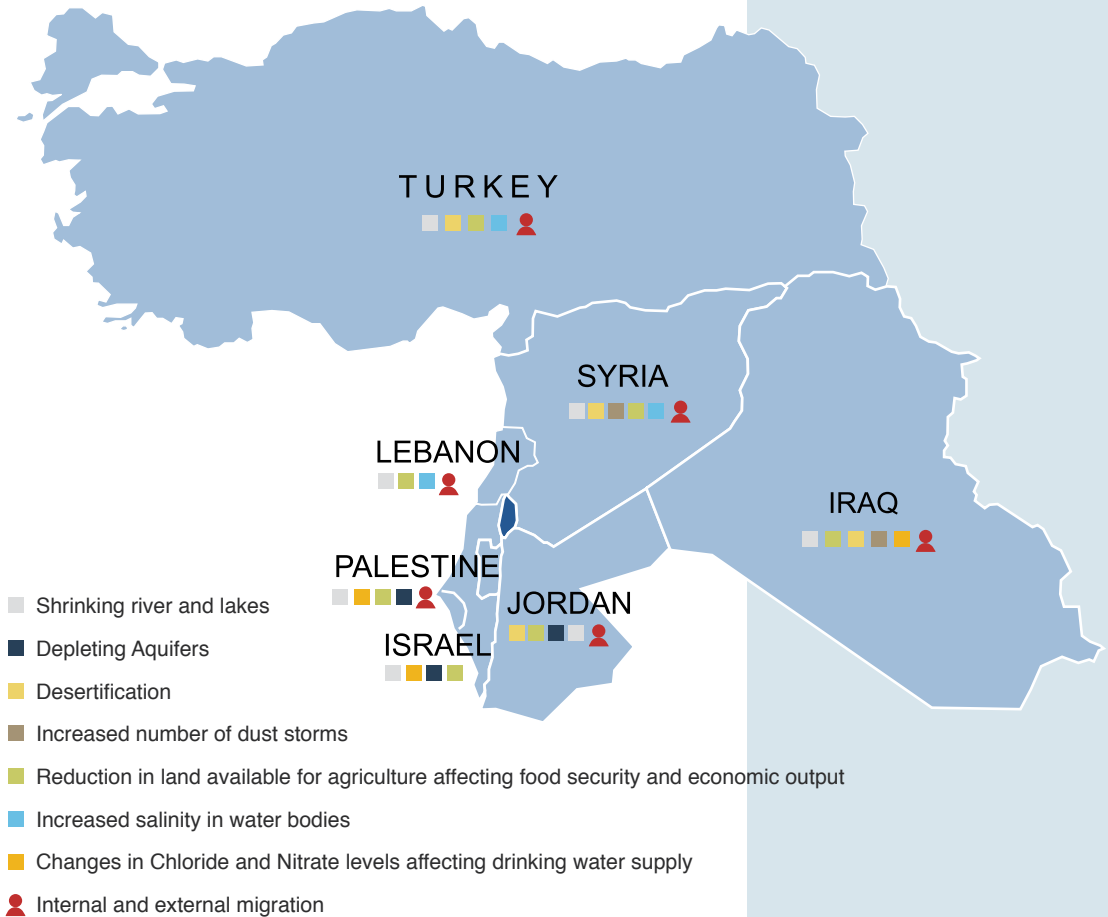
## 2. DEPENDENCY RATIOS



At the meeting of the Joint Jordanian - Syrian Higher Committee, the then Jordanian Prime Minister Nader Dahabi said the governments of Syria and Jordan will work to implement the directives of the two countries' leaders to have a comprehensive strategic vision for cooperation between them and with neighbouring countries, especially Turkey and Gulf countries. "This cooperation will lead to joint studies to be conducted by the two countries regarding strategic issues, mainly in the areas of energy, transport and water."

(The Jordan Times, 20 October 2009)

### 3. MULTIPLICITY OF CRISIS



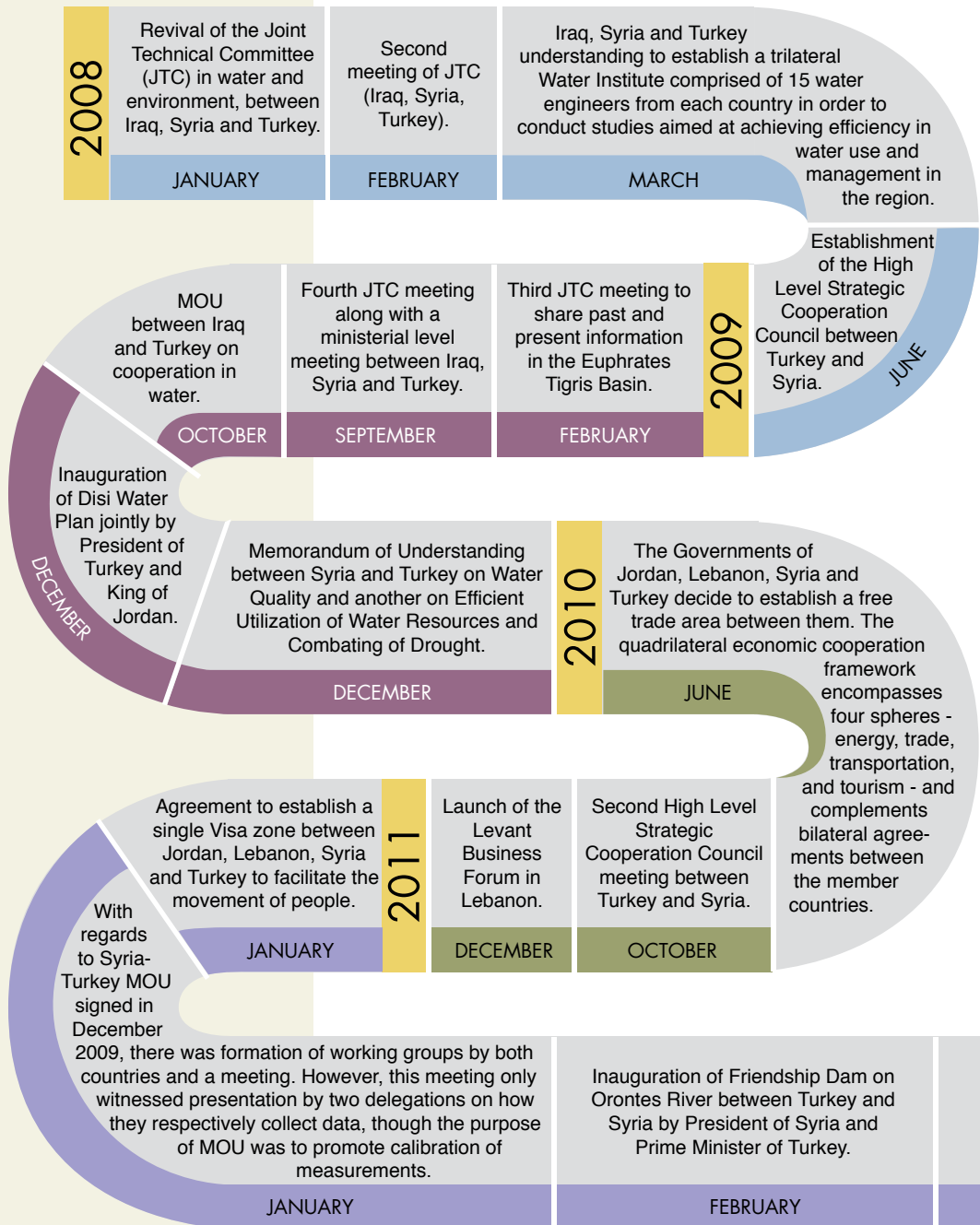
"I think the establishment of deep relationship and connection between Iraq and Turkey based on joint interest and mutual respect will be the sample to regional cooperation and understanding. Rapid development in our bilateral relationship with the neighbouring Turkey is a strong evidence of the fact that dialogue and mutual respect are the only way to boost best cooperation and understanding for the countries in the region."

Iraqi Prime Minister Nouri al-Maliki (17 October 2009)



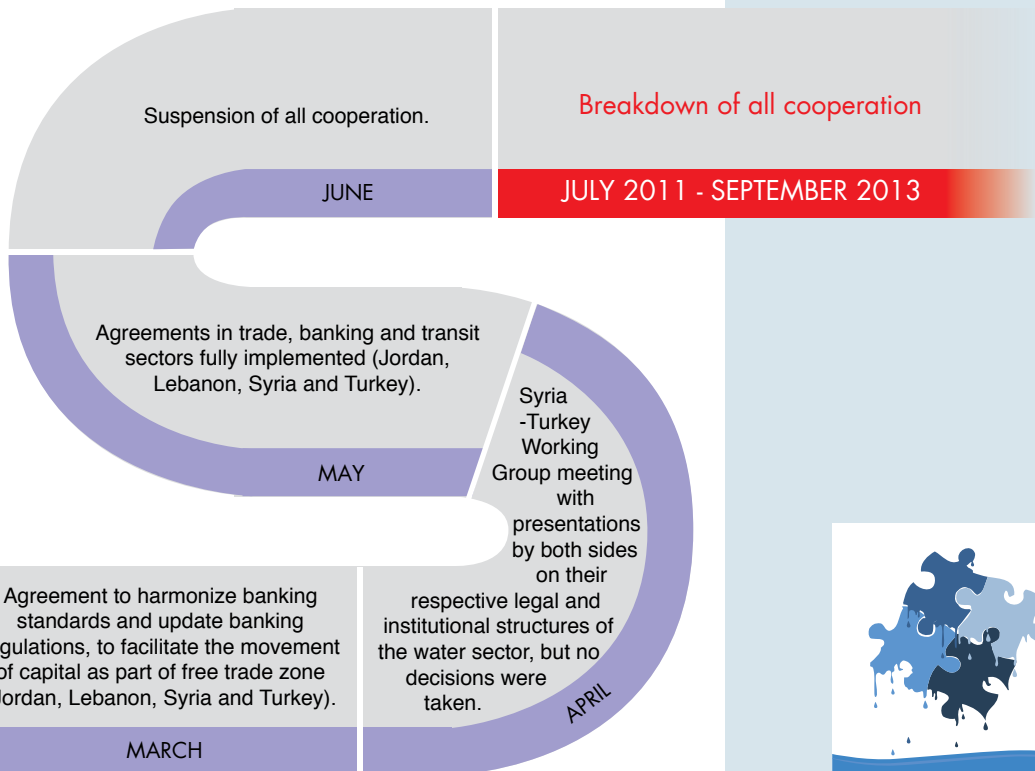
### 4. TIMELINE OF COOPERATION

Since 2008, a new spirit of cooperation was fostered in parts of the Middle East, in particular between Iraq, Jordan, Lebanon, Syria and Turkey. This has two dimensions: (1) trade and transit (2) water and environment.

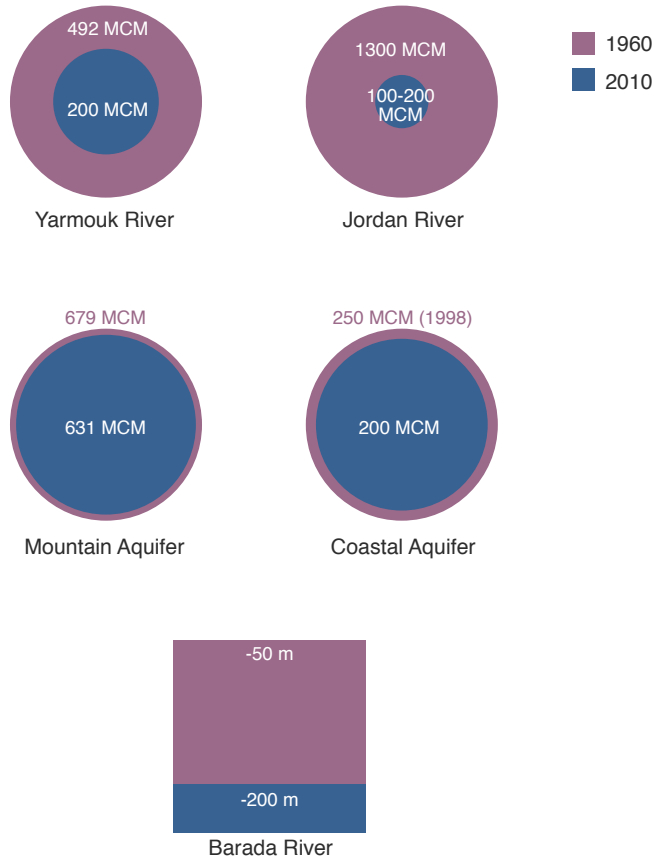


“Our aim is to turn the Mesopotamian basin into a joint area of stability and welfare through a wide spectrum of projects, from energy to trade, from health to construction and from water resources to transportation,”

Prime Minister Recep Tayyip Erdoğan of Turkey. (Today’s Zaman, 29 March, 2011)



## 5. DEPLETING RIVERS AND AQUIFERS



“Turkish businessmen should increase their investments and cooperation with Jordan in the water field. Regional cooperation is a must to tackle water issues. Turkey which suffers from water problems is open to any kind of cooperation on water.” Turkish President Abdullah Gul’s statement after inaugurating the headquarters for the Disi Water Plan in Coastal, Jordan, (Office of the President, 2 December 2009)



# PART TWO



## Introduction

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While water bodies do not respect man made political boundaries, we do know that they are affected by a host of circumstances. These circumstances, environmental, political or economic, become central to any form of management required to protect water resources. In Part I we have seen that there is a strong correlation between the presence of any cooperative mechanism in water and the reduction in risk of conflict or tension between countries that share the water.

Part II aims to acquaint the readers with common and unique concerns faced by 10 water bodies around the world and the organisations that manage or govern these bodies. More importantly, it demonstrates how these concerns can be addressed and overcome within a cooperative framework. The 10 organizations have been analysed on the overarching themes of Political Will and Vision, Legal Arrangements, Sharing and Utilization of Water, Collection, Monitoring and Exchange of Data in River Basins, Environment and Climate Change and Dispute Settlement. While even the most developed and advance countries have faced problems in their shared water resources, such as Europe or North America, the presence of active cooperation has paved the way in finding solutions that are implementable. The following chapters detail some of the best practices and success stories across the world in the area of integrated transboundary water management. These lessons can be adapted and customised to any region in the world that is embarking on this endeavour.

The Middle East water scenario is complex and the region faces a host of issues. Each table in the following chapters also details what is lacking in different basins across the Middle East. It should be recognized that many issues that are present in the Middle East at the moment have been faced by one of more or the 10 basins at some point in their past. Many concerns relating to changes in climatic patterns, rapidly increasing population, over use of resources and others are still present and will continue to affect all river basins.



## Cooperative Arrangements Selected for Comparison

- Senegal River - OMVS: Highly institutionalized and comprehensive.
- Zambezi River - ZAMCOM: Fast track in a nascent stage.
- Orange-Senque River - ORASECOM: Successful interaction between a regional body, the Southern African Development Community and a river basin organization.
- Mekong River - MRC: Serious IWRM exercise by lower riparians though upper riparians involved only as dialogue partners.
- Amazon River - ACTO: Cooperation on water resources as the means to facilitate regional integration.
- La Plata Rivers - CIC: An example of dictatorial regimes setting aside their mutual distrust and cooperating over water resources for economic development.
- Danube River - ICPDR and Rhine River - ICPR: High emphasis on quality management with impressive results.
- Rio-Colorado Rivers - IBWC: Flexibility to adapt to real changes.
- Great Lakes of North America - IJC: Decentralised yet coordinated mechanism.

## Cooperative Arrangements Not Selected

- Chad River - Lake Chad Basin Commission: Nominal funds for the commission, absence of real political dialogue.
- Nile River - NBI: Confined to the technical level.
- Niger River - NBA: Contradictory assessments on the functioning of the commission.
- Indus River - IWT: India and Pakistan treaty about separation of waters and not about cooperation.
- Ganges River - Joint Committee: The India - Bangladesh treaty on allocation of water, with no effective cooperation.
- Amu Darya and Syr Darya: A regional treaty without functional cooperation.

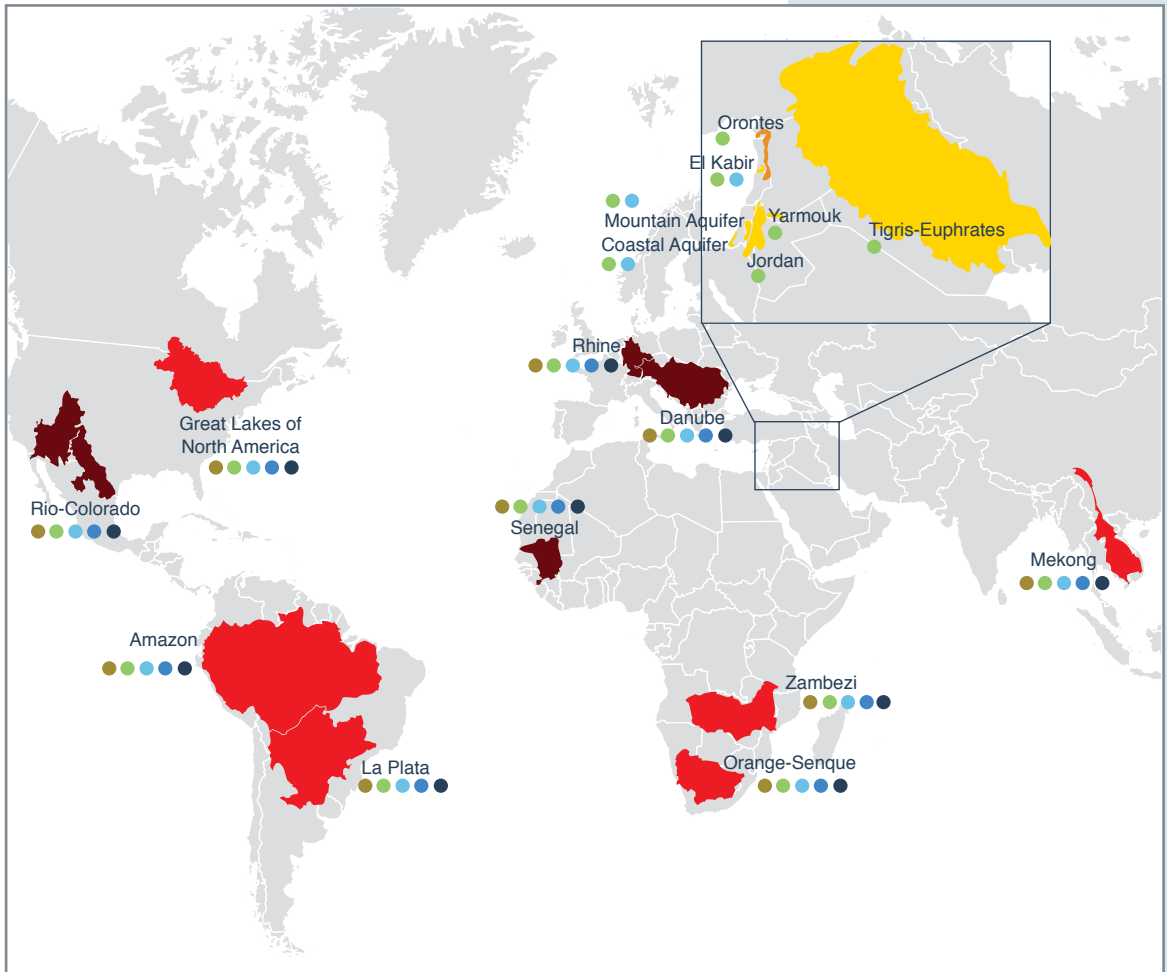
## Chapter 1 : Political Will

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This chapter focuses on factors that drive countries to choose cooperation over unilateral action when it comes to their water resources. Riparian countries that jointly manage and sustain the shared water bodies and have collaborative efforts towards future development are seen to have a higher level of trust. The chapter also looks at external actors that have aided in these efforts, either by providing technical expertise or financial support or both.



# 1. CONFIDENCE BUILDING MEASURES



**Demonstration of trust and political willingness among riparians**

- Very High
- High
- Medium
- Low

- Continuous Dialogue and Meetings
- Treaties and Agreements
- Involvement of all riparian states in some form
- Cooperation in other areas such as Economic
- Holistic vision and goals for the future

## 2. INVOLVEMENT OF REGIONAL AND INTERNATIONAL ORGANIZATIONS

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### Senegal

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**World Bank** - Played a key role in the process of integrating Guinea into OMVS

**Islamic Development Bank** - Financial contribution

### Zambezi

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**Southern African Development Community (SADC)** - SADC promoted Regional Dialogue. Binding Protocol on SADC Shared water courses(2000) acted as a framework/impetus for basin level treaty

### Orange-Senque

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**Southern African Development Community (SADC)** - SADC promoted Regional Dialogue. Binding Protocol on SADC Shared water courses (2000) acted as a framework/impetus for basin level treaty

### Mekong

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**Association of South East Asian Nations (ASEAN)** - Sub Group called Mekong Basin Development Commission (MBDC) was established to strengthen cooperation with China and Myanmar

**Asian Development Bank (ADB)** - ADB aided Greater Mekong Sub Regions Initiative (GMS)

**European Union (EU)** - Funding Climate Change Adaptation

**Australian and Belgian Development Cooperation** - Funding and development partners for Navigation Programme

**Several Donors** - Funding Mekong River Commission

### Amazon and La Plata

---

**Organization of American States (OAS)** - Support mechanisms for Intergovernmental Dialogue. Promotes national level implementation of IWRM

**Global Environment Facility (GEF) and United Nations Environment Programme (UNEP)** - Fund and implement environment protection programmes

## Rhine and Danube

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- European Union** - European Union Water Framework Directive (EUWFD)  
(Directive 2000/60/EC)
- UNECE Convention on the Protection and Use of Transboundary Watercourses and International Lakes (Water Convention), 17 March 1992

## Orontes

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**GEF, UNEP, World Bank** - Coastal and Orontes River Basins Water Resources Management Project

## Mountain Aquifer

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**European Commission** - Emergency Water and Sanitation-Hygiene (EWASH) group to coordinate the work in the water, sanitation and hygiene

## Gaza Aquifer

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**World Bank** - North Gaza Emergency Sewage Treatment Project (NGEST)

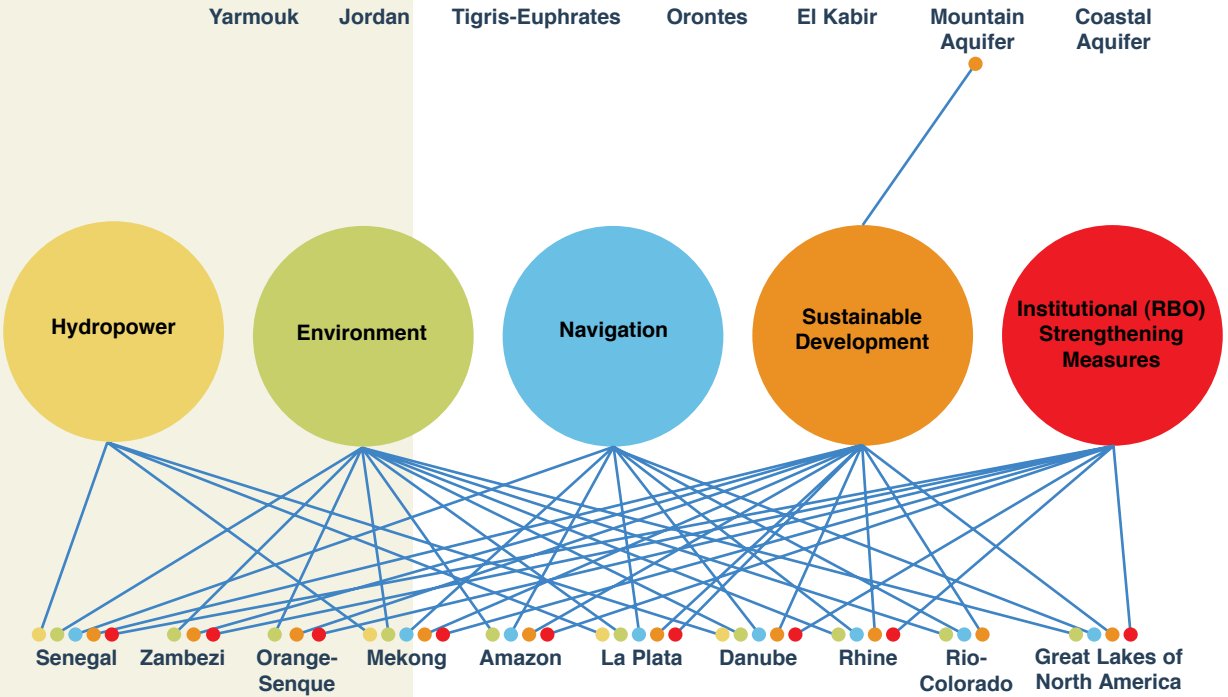
**European Commission** - Emergency Water and Sanitation-Hygiene (EWASH) group to coordinate the work in the water, sanitation and hygiene



### 3. JOINT ENDEAVOURS

This table is reflective of joint actions undertaken by the majority or all of the riparian states for comprehensive integrated development of the river basin. For example, riparian states construct hydropower projects or implement programmes for environment protection within their own territory, but when these programmes are jointly implemented for the development or the management of the river basin area, it indicates collaborative efforts that help improve overall relations between the countries.

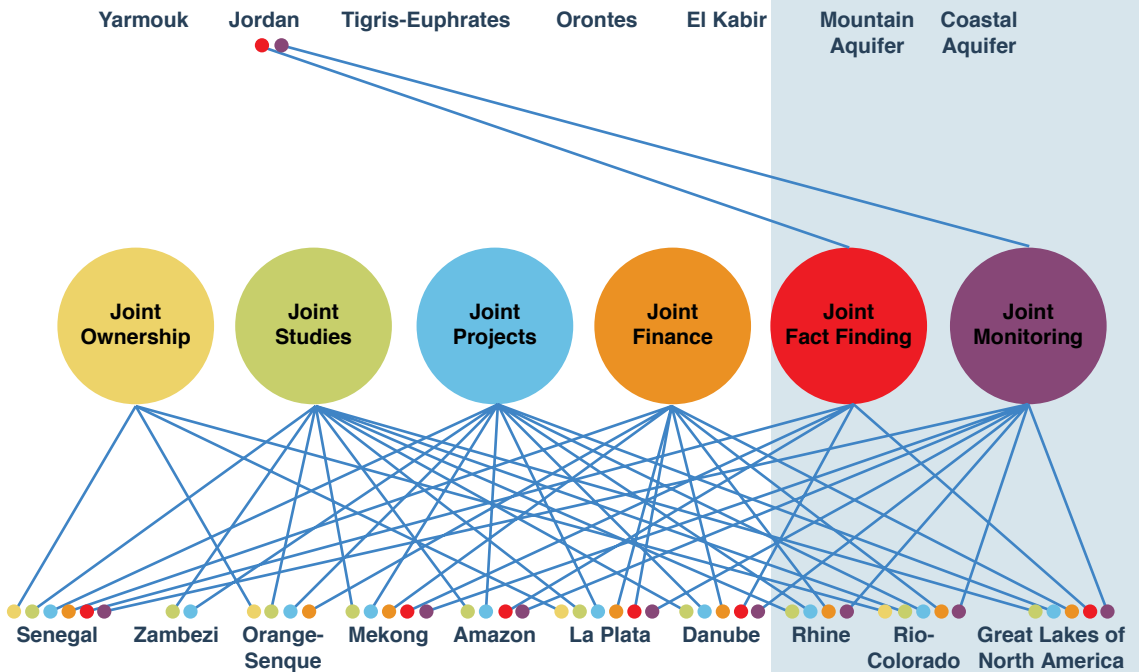
#### Areas of Joint Action



*Mountain Aquifer - Sustainable Development: Small scale projects mostly implemented by the development, scientific and academic community.*



## Types of Joint Endeavours



### The Case of Botswana

Botswana chose to be a part of ORASECOM because it gained a unique political advantage by cooperating with the Orange-Senque countries. By being a part of the RBO, Botswana places itself in a bargaining position whereby by extending support to some of the riparians in Orange-Senque Basin, it may garner concessions from the same riparians in other basins where it has a greater stake. For example, Botswana has a greater stake in Okavango River basin and Zambezi which also includes Namibia. By supporting Namibia in ORASECOM, it can get similar support or concessions from Namibia in Okavango as well as in Zambezi. This example demonstrates that it is at times better to look at a hydro political region, comprising of many basins, rather than one basin in isolation.



## Chapter 2 : River Basin Organizations

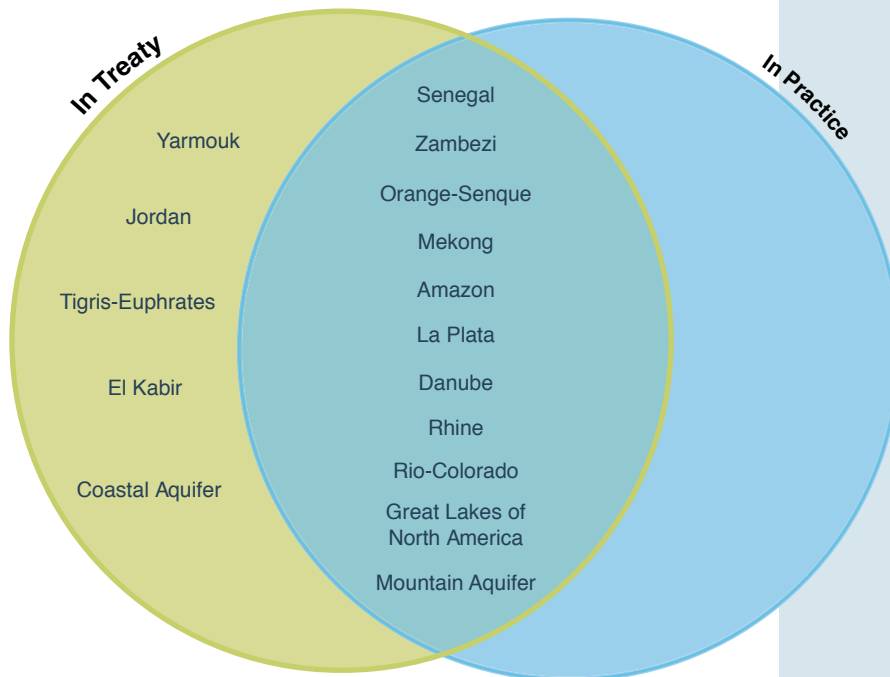
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This chapter gives us an insight into the nature, structure and functions of 10 successful River Basin Organizations (RBOs) around the world and the relevance of their experience to the Middle East. It is important to note that while there is no set prototype of an organization or commission, there are common functions which can help towards forming a basic model. For example, most RBOs have an established structure involving a decision making body, an executive and a secretariat. The RBOs also encourage participation in some form by all riparian states. There are several variations that exist in RBOs which were introduced to suit the needs of the particular basin and the countries involved. For example, the levels of engagement as well as the levels of centralization differ from basin to basin. Hence, while Senegal witnesses the highest level of involvement with the Head of States and a highly centralized system, Rio Colorado on the other hand witnesses the involvement of mostly government officials with a fairly decentralized, yet coordinated method of water management.



## 1. IN LETTER AND IN SPIRIT

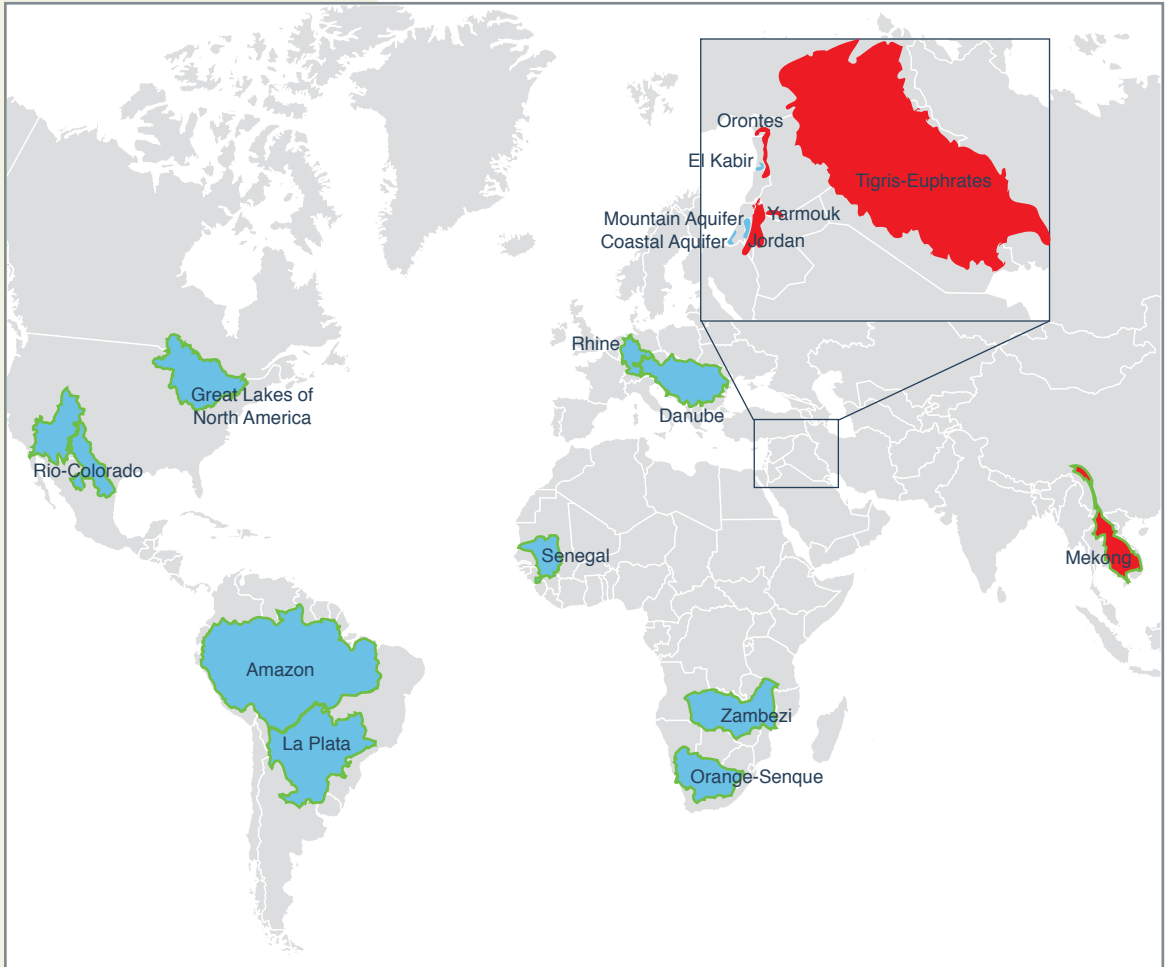
River Basin Organizations sometimes exist in treaties but not in function or in practise. This is the main difference between treaties in and outside the Middle East.



- Zambezi currently has an interim structure in place
- Yarmouk has a Joint Water Commission between Jordan and Syria
- Jordan refers to Joint Water Commission between Israel and Jordan
- Tigris-Euphrates: Joint Technical Committee between Syria, Turkey and Iraq was created in 1982, disbanded in 1993 and revived in 2009
- El Kabir: Syrian-Lebanese Joint Committee
- Orontes data is not available

## 2. INCLUSION AND EXCLUSION OF RIPARIAN COUNTRIES

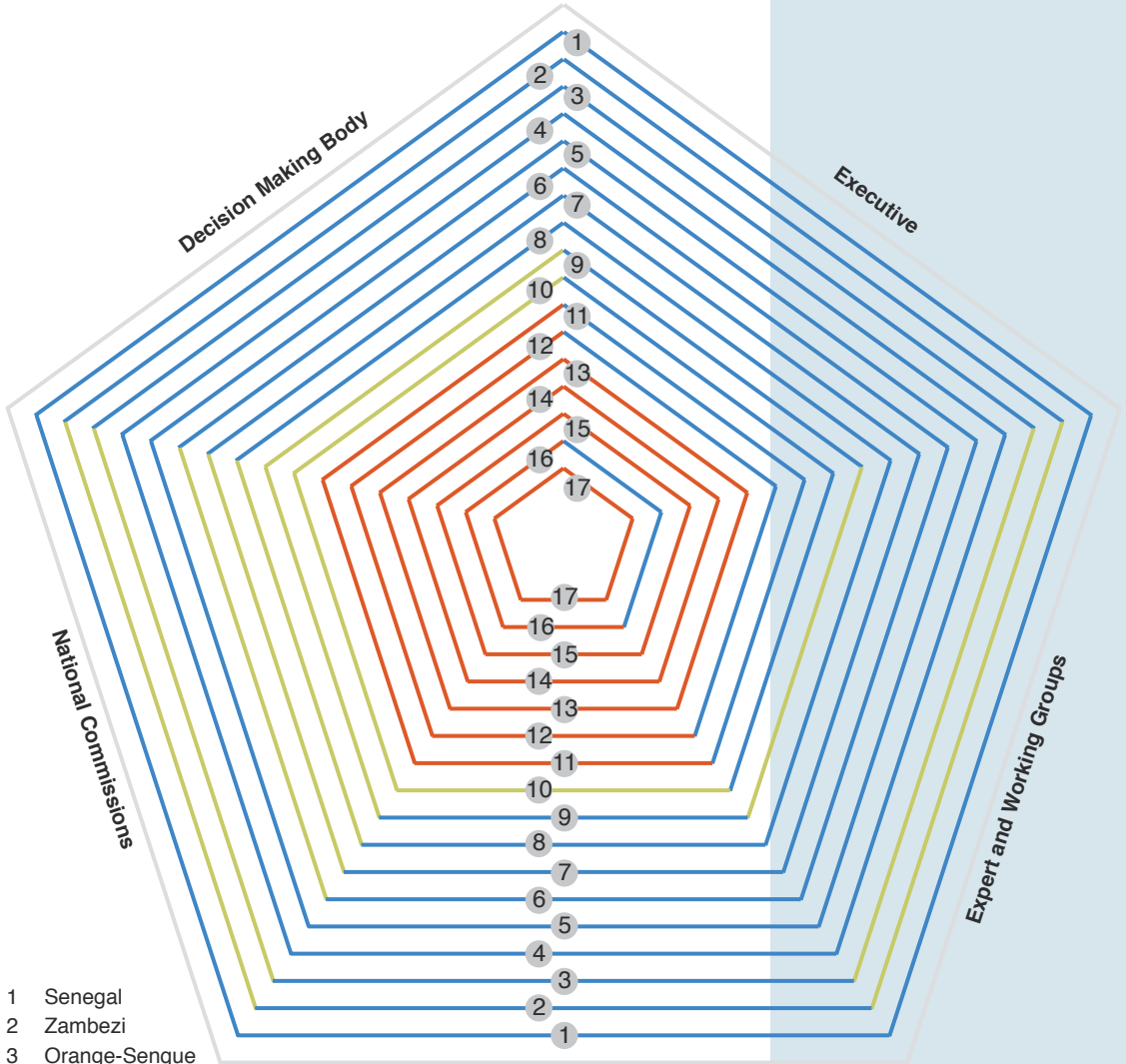
- When all the riparian states are members
- When one or more riparian state is not a member
- Legal personality is bestowed upon the River Basin Organization by its establishing treaty or agreement. It grants the RBO certain powers which make them an independent body, not subject to any state's absolute control.



*In both the Danube and Rhine basins countries which share a very small portion of the river are not a part of the RBO, however the European Union as an entity is a member to both the organizations. Zambezi River Commission is considered inclusive even without DRC as a member because a very small part of the basin lies in the DRC.*

*\*while the treaty studied for Yarmouk and Jordan basin state that an organization will have a legal personality, it is yet to be put into practice*

### 3. ORGANIZATIONAL STRUCTURES



- 1 Senegal
- 2 Zambezi
- 3 Orange-Senque
- 4 Mekong
- 5 Amazon
- 6 La Plata
- 7 Danube
- 8 Rhine
- 9 Rio-Colorado\*
- 10 Great Lakes of North America\*
- 11 Yarmouk
- 12 Jordan\*\*
- 13 Tigris-Euphrates
- 14 Orontes
- 15 El Kabir
- 16 Mountain Aquifer
- 17 Coastal Aquifer

**Decision making bodies:** comprises of one or more of the following - Heads of States or Council of Ministers or designated government officials

**Executive:** Could refer to a commission or a technical committee or body of experts

**Secretariat:** Administrative unit of RBO

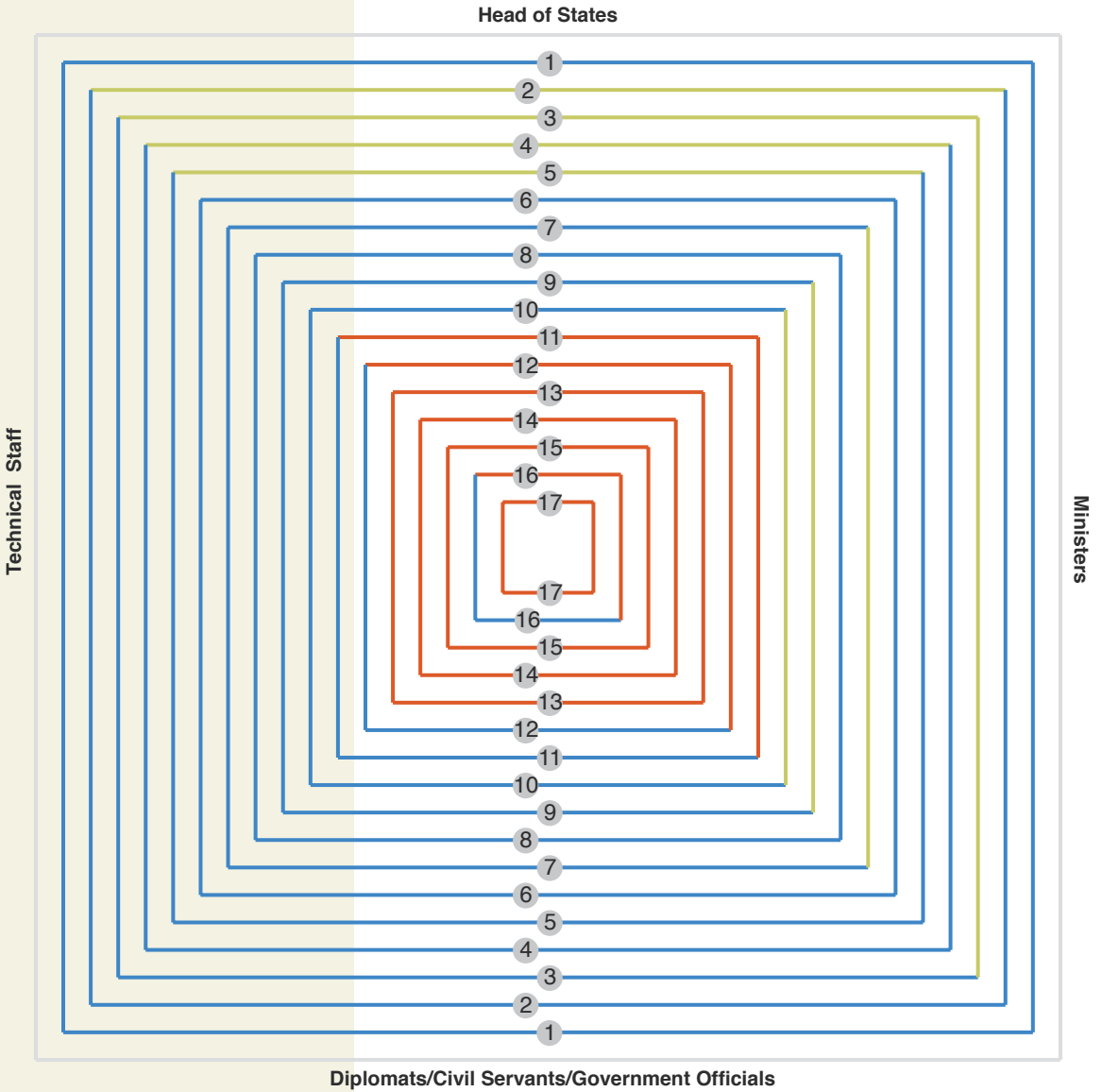
- Present
- Absent
- Not Relevant



\* The Executive bodies do have some decision making abilities.

\*\* Refers to Joint Water Commission between Israel and Jordan.

### 4. LEVELS OF ENGAGEMENT



- 1 Senegal
- 2 Zambezi
- 3 Orange-Senque
- 4 Mekong
- 5 Amazon
- 6 La Plata
- 7 Danube
- 8 Rhine
- 9 Rio-Colorado

- 10 Great Lakes of North America
- 11 Yarmouk\*
- 12 Jordan
- 13 Tigris-Euphrates
- 14 Orontes
- 15 El Kabir
- 16 Mountain Aquifer
- 17 Coastal Aquifer

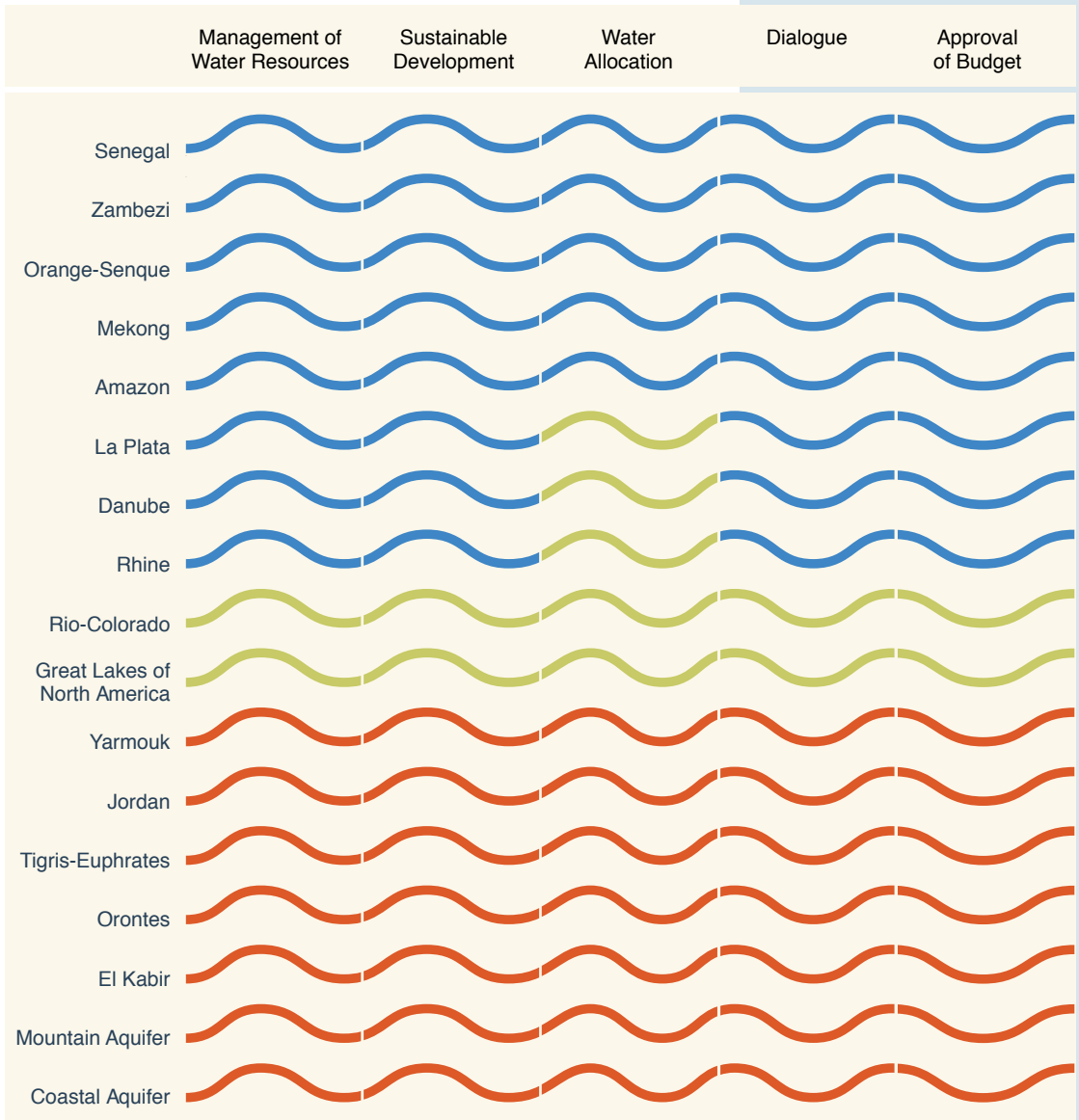
- Yes
- No
- Not Relevant

\* In the Yarmouk, the level of engagement is between very low level government officials.

## 5. FUNCTIONS

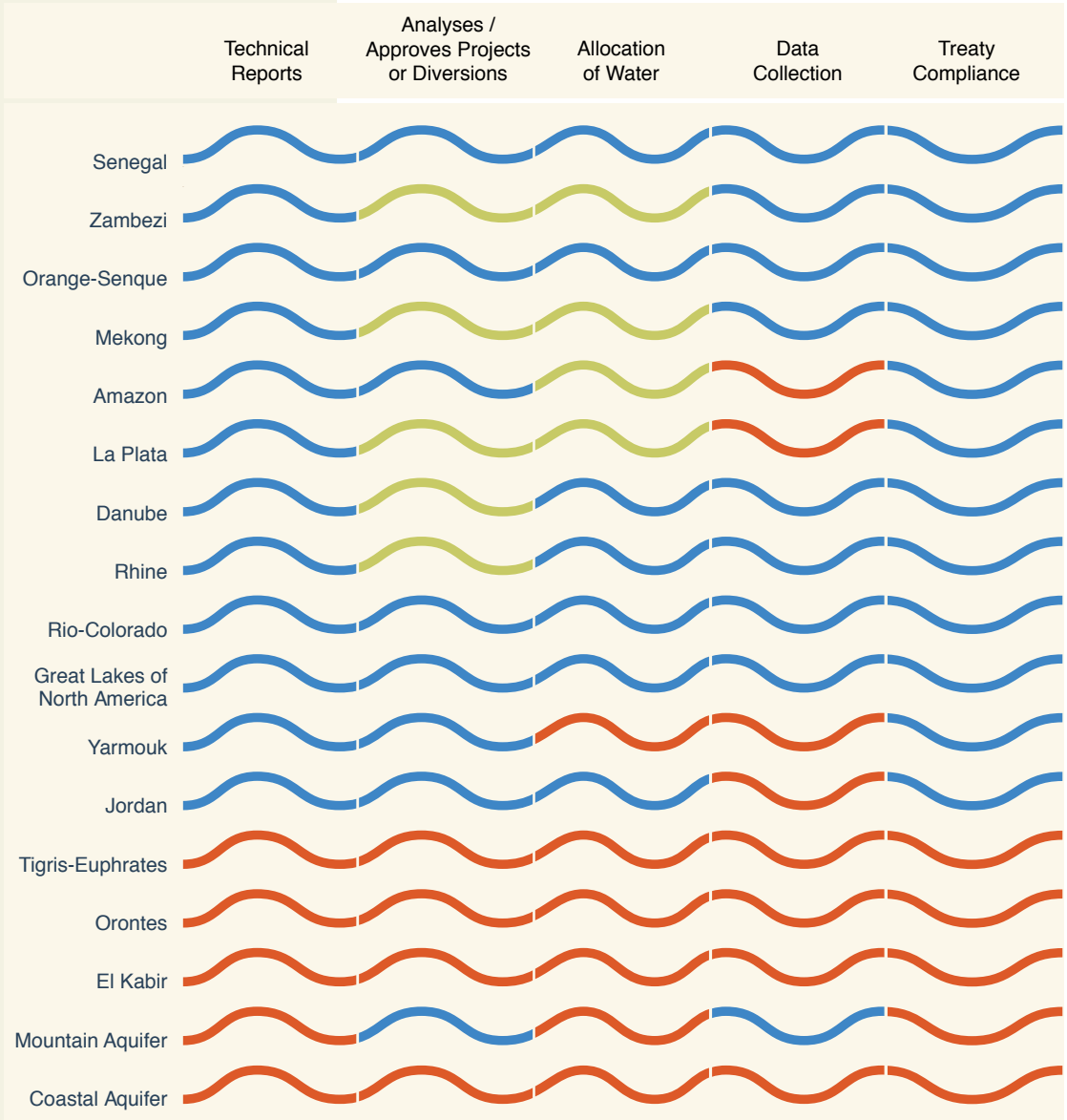
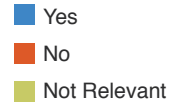
### Decision Making Body

Lays down policies and takes decisions on water allocation, sustainable use of water resources, finances, approves plans and strategies on river basin management, serves as forum for dialogue for parties and oversees the implementation of the provisions of the treaty.



## Executive Body

An executive body along with technical and working groups is responsible for implementing the policies and decisions of the decision making body, preparing technical reports, approval of projects or diversions. It looks into water allocations, data collection, and ensures treaty compliance.

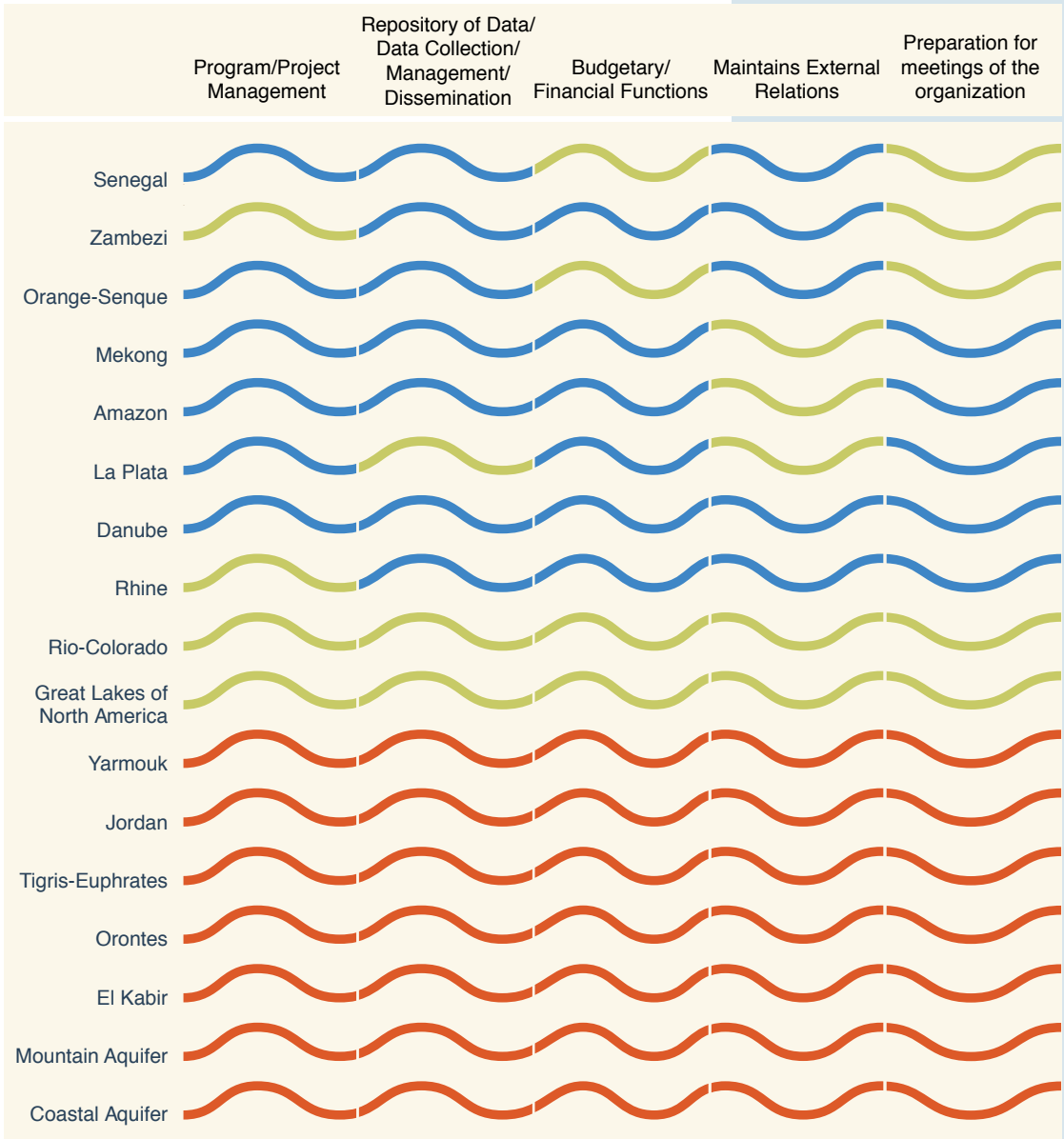




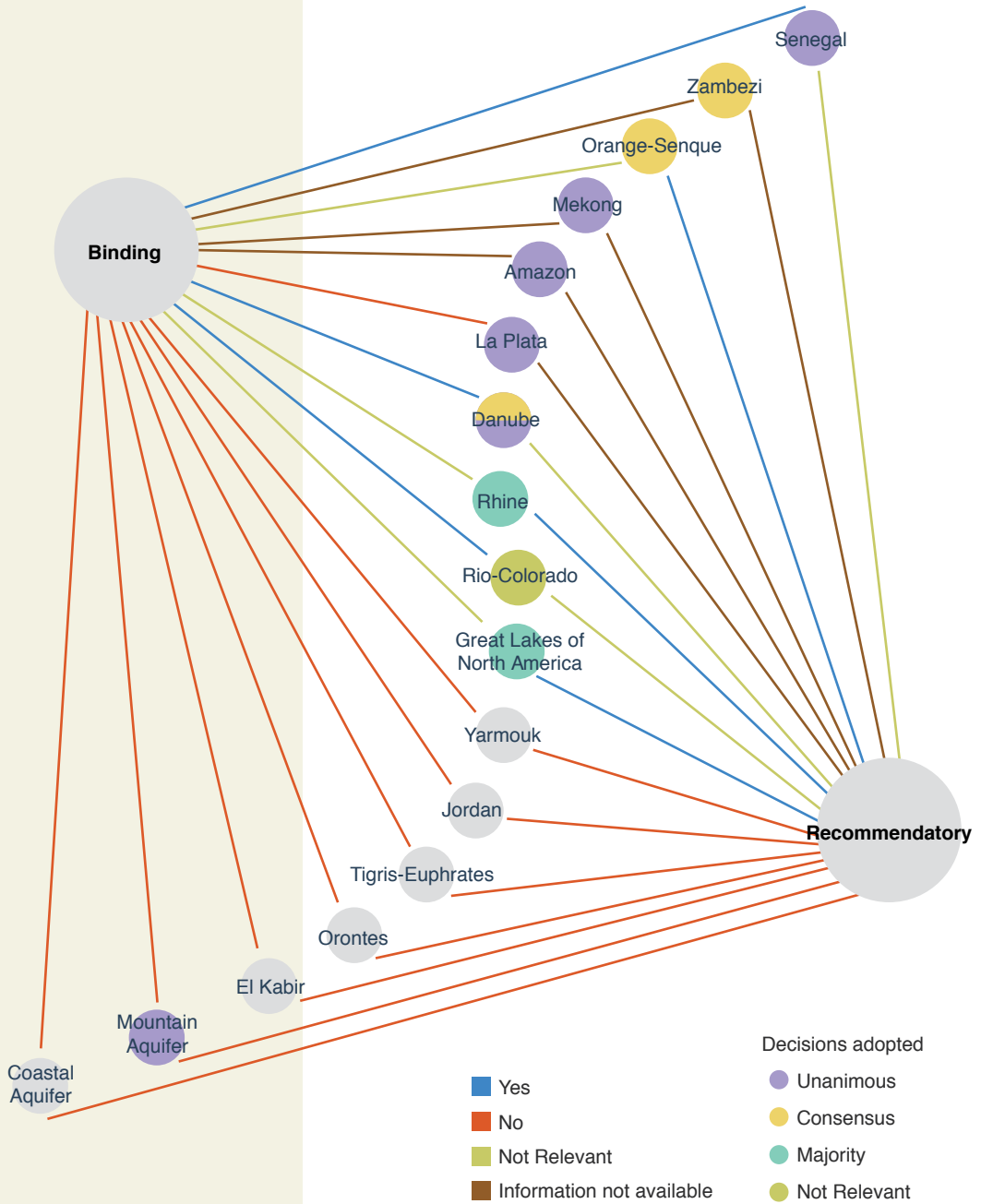
- Yes
- No
- Not Relevant

### Secretariat

Provides logistical and administrative support.



## 6. NATURE OF DECISIONS



\* Great Lakes of North America: If there is no majority then recommendations are submitted to the highest level of government.

## 7. MEETINGS

Basin	Unit	Number (Annually)	Possibility of having Extraordinary/ Emergency Sessions
Senegal	Conference of Heads of States and Governments	1	Yes
	Council of Ministers	2	
Zambezi	-	1st Meeting to establish ZAMCOM Technical Committee was held on 01 November 2012	Yes
Orange-Senque	Council of State Representatives	1	Yes
Mekong	Council of Ministers	1	Yes
	Joint Committee	2	
Amazon	Meetings of Ministers of Foreign Affairs	As and when required (Have been 10 so far)	Yes
	Amazonian Cooperation Council	1	
La Plata	Ministers of Foreign Affairs	1	Yes
Danube	Conference of Parties	1	Yes
Rhine	Plenary meetings of Commission	1	Yes
	Ministers of the Parties	Every 3-4 years.	
	Working groups	3	
Rio-Colorado	■	■	■
Great Lakes of North America	■	■	■
Yarmouk	■	■	No
Jordan	Joint Water Commission	1	■
Tigris-Euphrates	■	■	■
Orontes	■	■	■
El Kabir	■	■	■
Mountain Aquifer	Joint Water Committee	10-12/year (suspended)	■
Coastal Aquifer	■	■	■

■ Meetings not taking place

■ Data not available





### **Reporting and Implementation Mechanisms: Rhine River Basin**

In the Rhine River basin, the parties are required to regularly report on the measures taken by them to implement the decisions adopted by the Commission within the stipulated time period. The parties report on the progress of each project, as well as impediments, if any. If parties cannot implement the decision in part or in full, they are required to make a report to the Commission within a stipulated time period, as decided upon by the Commission on an ad hoc basis. The Commission then decides on measures that could be taken to ensure that decisions are implemented.

## Chapter 3 : Legal Arrangements

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This chapter examines the treaties or agreements governing trans-boundary watercourses in select basins. A comparison of the various provisions in these legal instruments brings out the similarities and the dissimilarities existing amongst them. For example a majority of the treaties have general provisions on cooperation, territorial integrity, and settlement of disputes as well as environmental protection. Also, most instruments contemplate the formation of a River Basin Organization which has specific powers and functions. A system of data collection and the manner of utilization is usually agreed upon. However, the method of classification of the shared watercourses is seen to be different in different basins.

This chapter also presents a list of unique provisions which have been adopted by the riparians. For example Danube has a provision for the protection of secret and confidential information relating to the trans-boundary water body which is shared by contracting parties. This provision ensures that data shared by the riparians are not misused. These provisions give a distinctive character to the water sharing agreements which could be imitated in other basins as well.

The form of comparative analysis done in this chapter thus serve three main purposes - a) It showcases various elements that have been agreed upon by riparian nations; b) It could serve as the basis for the construction of an agreement between riparians; and most importantly c) It could serve as a point of reference to compare the actions of the states in practice with what has been agreed upon by them in the treaties or agreements.

Data on Orontes is not available for many of the legal aspects.



## 1. TREATIES

The tables below refer only to the main RBO forming treaties mentioned in the Annexure, unless specifically stated.

### Perambulatory Clause

A preamble of a treaty is the most important part of a treaty. It elucidates the object and purpose of the treaty. It often encapsulates the reasons for the parties to enter into the treaty.

Basin	Year	Objective*
Great Lakes of North America	1909	Security (United States, Canada)
Rio-Colorado	1944	Security, Sustainable utilization of water (United States, Mexico)
La Plata	1969	Sustainable utilization of water (Argentina, Bolivia, Brazil, Paraguay, Uruguay)
Senegal	1972	Economic development (Senegal, Mali, Mauritania)
Shatt al'Arab	1975	Utilization of water, Security (Iran, Iraq)
Amazon	1978	Economic development (Bolivia, Brazil, Colombia, Ecuador, Guyana, Peru, Surinam, Venezuela)
Yarmouk	1987	Utilization of water (Jordan, Syria)
Tigris-Euphrates	1987	Security (Turkey, Syria)
Jordan	1994	Security (Jordan, Israel)
Orontes	1994	Utilization of water (Syria, Lebanon)
Mekong	1995	Economic development (Cambodia, Laos, Thailand, Vietnam)
Mountain Aquifer	1995	Utilization of water (Israel, Palestine Territories)
Coastal Aquifer	1995	Utilization of water (Israel, Palestine Territories)
Danube	1998	Sustainable utilization of water (Germany, Austria, Czech Republic, Slovakia, Hungary, Slovenia, Croatia, Bosnia and Herzegovina, Serbia, Montenegro, Romania, Bulgaria, Moldova, Ukraine, EU)
Rhine	1999	Sustainable utilization of water (Switzerland, France, Germany, Netherlands, Luxemburg, EU)
Orange-Senque	2000	Sustainable utilization of water (South Africa, Botswana, Namibia, Lesotho)
El Kabir	2002	Utilization of water (Syria, Lebanon)
Zambezi	2004	Sustainable utilization of water (Zambia, Angola, Zimbabwe, Mozambique, Tanzania, Botswana, Namibia)
Orontes	2009	Economic Development (Syria, Turkey)

\*The object and purpose has been identified from the parts of the treaty that specifically deal with water.

## 2. SCOPE

An RBO treaty states amongst other things

- The name of the water course and its classification
- Whether the transboundary water also includes ground water.

Classification of Water Body in the Treaties		
International Water Course	Common Water Source / Water source of Common Interest	No Classification
Senegal	Zambezi	Amazon
Shatt al'Arab*	Orange-Senque	La Plata
	Mekong	Danube
		Rhine
		Rio-Colorado
		Great Lakes of North America
		Yarmouk
		Jordan
		Tigris Euphrates (Syria-Turkey)
		El Kabir
		Mountain Aquifer
		Coastal Aquifer

\* The treaty between Iran and Iraq states that Shatt al'Arab is an international water way (Article 9)

### Inclusion of Ground Water in the Treaty

- Yes
- No

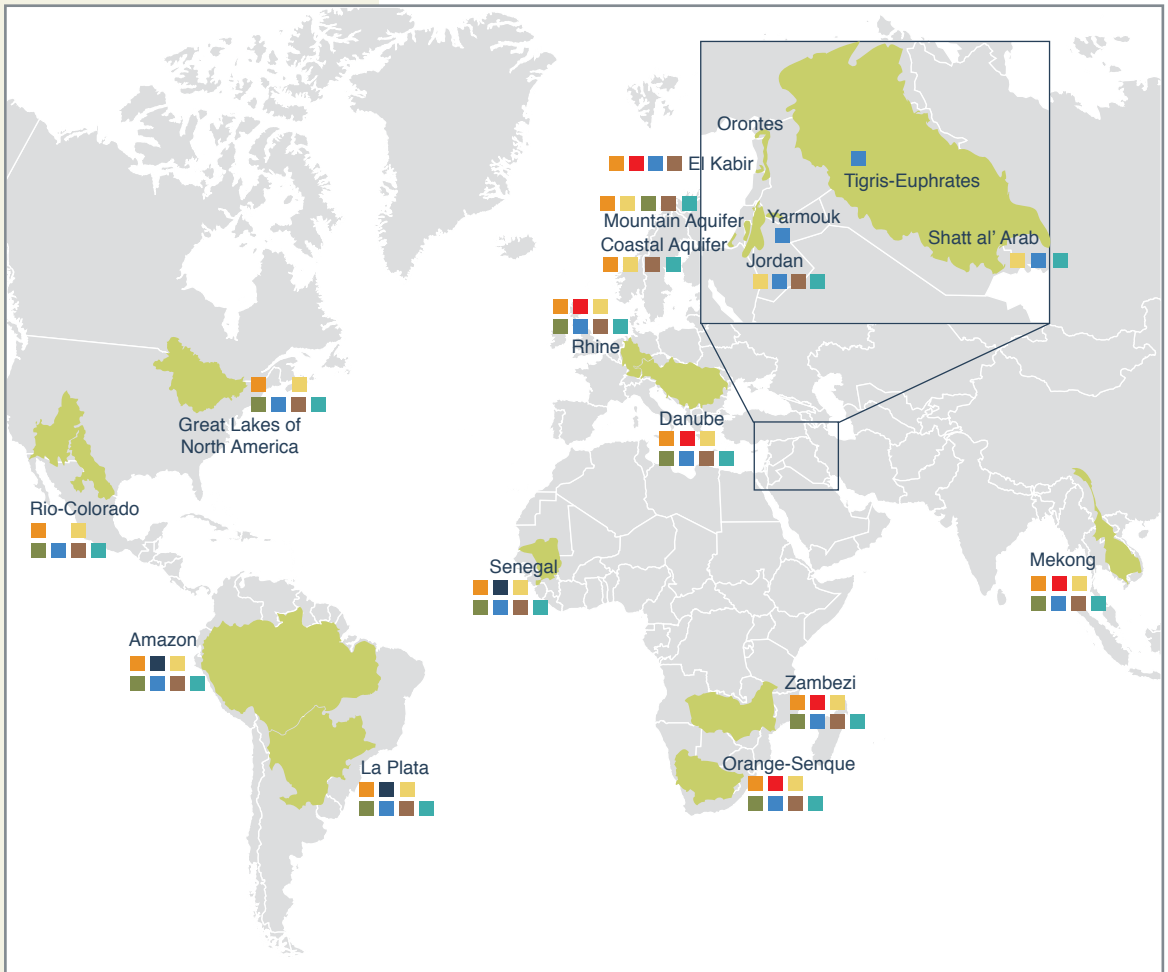
In the Mekong River Basin, 13 subsequent agreements have been entered into by the countries on Transboundary Aquifers. Similarly, there may be subsequent agreements for other aquifers such as Guarani Aquifer in the La Plata River Basin. However, this table primarily addresses provisions within the RBO treaties that were originally signed.

Only the 1987 Agreement between Turkey and Syria has been studied in this chapter as the text for the others are not available. In all other chapters that deal with operational matters of the RBOs, MoUs signed between all countries of the Tigris Euphrates Basin have been considered.



### 3. GUIDING PRINCIPLES

They are the fundamental principles that act as a guide in every action taken by the states with respect to the river basin. In the case of the Middle East region, while principles were laid out in the treaty, they are not being followed by the countries in most cases.



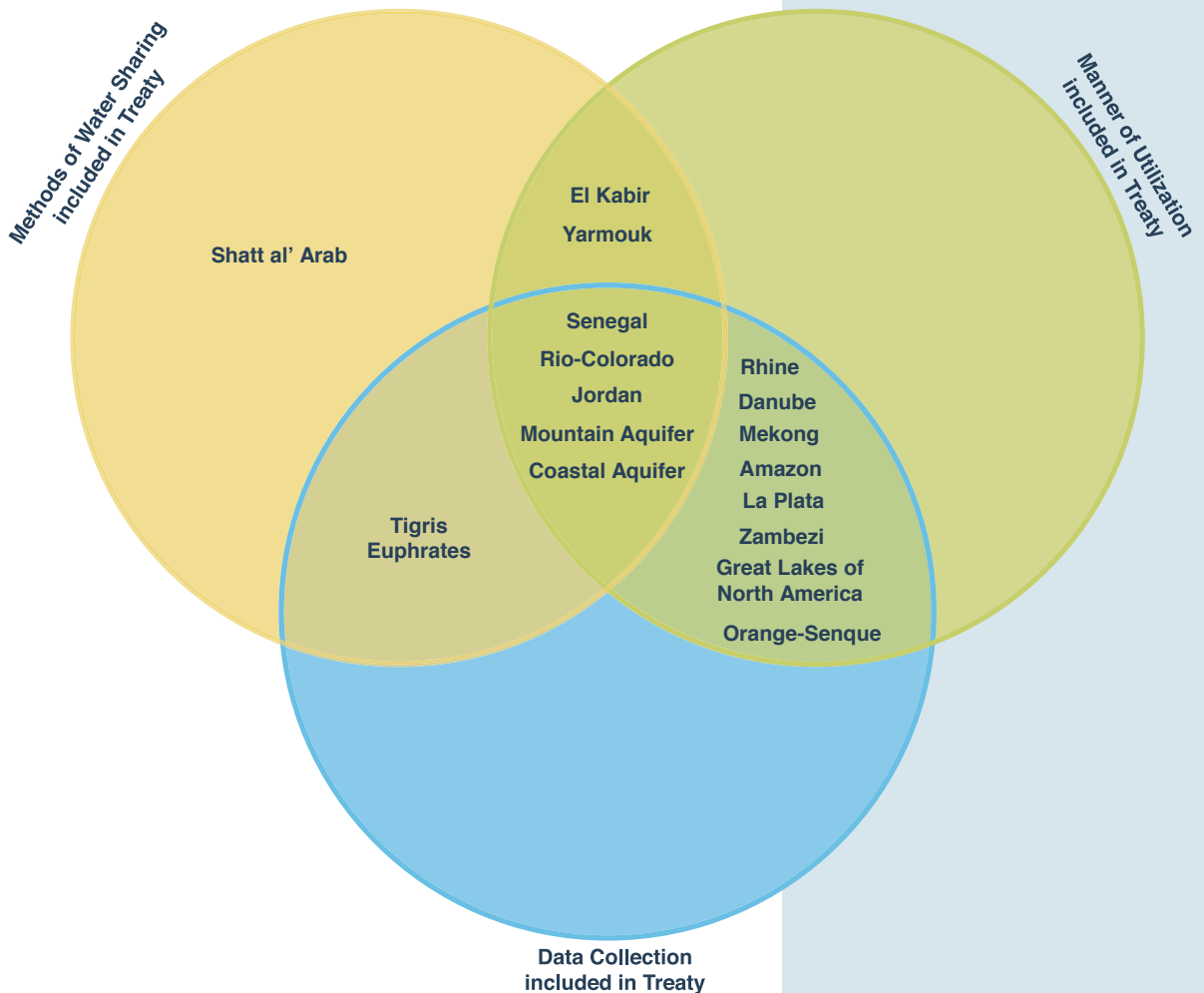
- |   |  |
|---|--|
| <span style="color: orange;">■</span> Cooperation                       | <span style="color: olive;">■</span> Sustainable Development                   |
| <span style="color: red;">■</span> Equitable and Reasonable Utilization | <span style="color: blue;">■</span> Territorial Sovereignty                    |
| <span style="color: darkblue;">■</span> Rational Utilization            | <span style="color: brown;">■</span> Environmental Protection and Conservation |
| <span style="color: yellow;">■</span> No Harm                           | <span style="color: teal;">■</span> Peaceful Settlement of Disputes            |

\* OMVS 1972 does not have any provision with respect to equitable and reasonable utilization. Water Charter 2002 under Article 5 provides for principle of fair and rational use.



## 4. RIGHTS AND OBLIGATIONS OF STATES

### Sharing of Water and Data

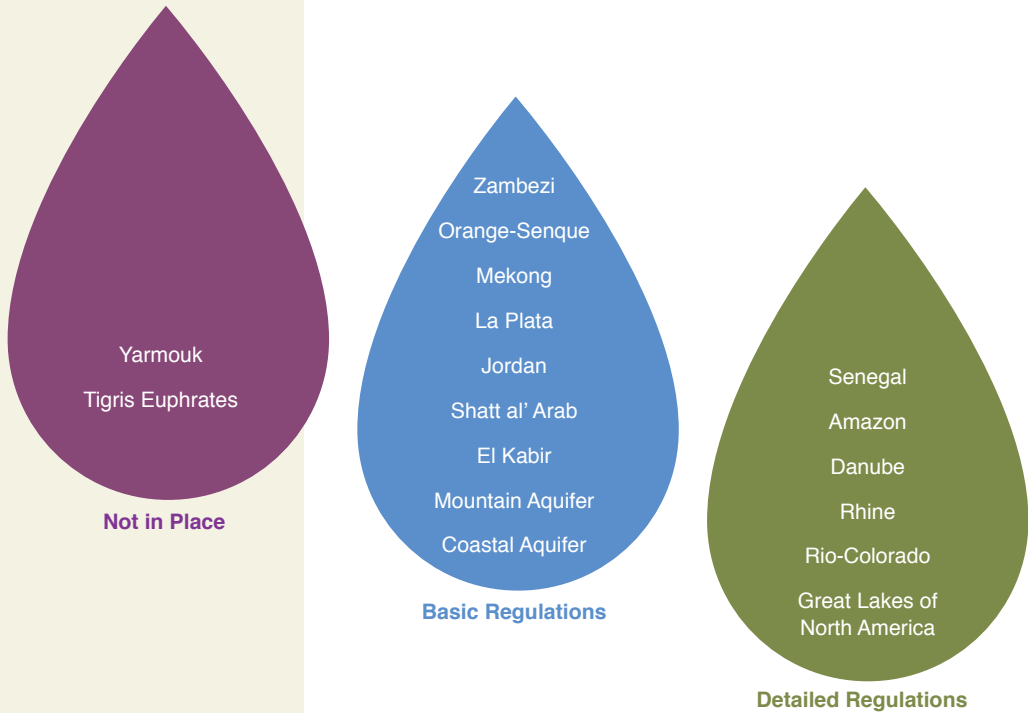


\* Article XII of Agreement on Yarmouk (Jordan-Syria) States that “each state shall have the right to make use of the portion of the lake formed by the dam that is situated in its territory and to exploit, utilize and maintain it for purposes of tourism and pisciculture that do not conflict with the administration of Wahdah Dam installations”.

From the above, it can be noted that while most river basins do not have an arrangement for division/separation or sharing of water, however they have agreed that each riparian uses water resources equitably or rationally within their territory such that it does not cause harm to the interest of other riparian states.



## Treaty Provisions for Environmental Protection



*\*The treaty states that States should establish a commission to draw up rules for the prevention and control of pollution.*

**Basic Regulations:** This means that the treaty contains few provisions with respect to environmental protection which is general or broad in character thus giving the riparians the liberty to do what they deem fit within the basic framework given in the treaty to protect the environment.

**Detailed Regulations:** This means that the treaty contains very specific provisions to protect the environment. It could be in the RBO treaty or subsequent treaties entered into specifically for the purpose of environmental protection. For example, Great Lakes of North America Water Quality Agreement has very detailed provisions to deal with environmental protection.

## 5. FINANCE AND DISPUTE RESOLUTION MECHANISM

### RBO-Scope, Structure and Functions

Not in place/ Unclear	Basic Provisions	Detailed Provisions
Tigris Euphrates (Syria- Turkey)	Amazon Jordan El Kabir Shatt al'Arab Coastal Aquifer	Senegal Orange-Senque Zambezi Mekong Rio-Colorado Great Lakes of North America Rhine Danube Yarmouk La Plata Mountain Aquifer

### Finance

Absent	Present
Amazon Zambezi Mountain Aquifer Coastal Aquifer	Orange-Senque La Plata Mekong Tigris Euphrates (Syria-Turkey) Shatt al'Arab El Kabir Senegal Rhine Danube Rio- Colorado Great Lakes of North America

### Dispute Resolution Mechanism

Absent	Present
Amazon La Plata Yarmouk Tigris Euphrates (Syria-Turkey) El Kabir	Senegal Zambezi Orange-Senque Mekong Rio-Colorado Great Lakes of North America Jordan Shatt al'Arab Rhine Danube Mountain Aquifer Coastal Aquifer

*The Orontes does not feature in any table as the information is not available.*



## 6. PROVISION FOR REVISION OR AMENDMENT

		■ Not Present	■ Data Not Available
<b>Senegal</b>	Revision	—	— Member makes request in writing to the President of the Conference of The Heads of State and Government
<b>Zambezi</b>	Amendment	—	Done by the decision of the Council
<b>Orange-Senque</b>	Amendment	—	By mutual consent of Parties
<b>Mekong</b>	Amendment	—	By mutual agreement
<b>Amazon</b>	Amendment	—	By mutual agreement
<b>La Plata</b>	Amendment	—	By Ministers of Foreign Affairs at an extraordinary meeting by a unanimous vote
<b>Danube</b>	Amendment	—	Contracting Party proposes amendments and communicates them to the Depository. Amendment is to be adopted by consensus at the Conference of Contracting states
<b>Rhine #</b>		■	■
<b>Rio-Colorado*</b>	Revision	—	Minutes
<b>Great Lakes of North America*</b>	Revision	—	Minutes
<b>Yarmouk (Jordan)</b>	Amendment	—	By annexures to the original treaty
<b>Jordan</b>		■	■
<b>Tigris Euphrates (Syria-Turkey)</b>		■	■
<b>Shatt al' Arab</b>		■	■
<b>Orontes</b>		■	■
<b>El Kabir</b>	Amendment	—	By annexures to the original treaty
<b>Mountain Aquifer</b>		■	■
<b>Coastal Aquifer</b>		■	■

# While nothing is detailed in the treaty the parties follow a system of enforcing new decisions pertaining to the management of the basin taken by the Council of European Union (2000/706/EU)

\* In the case of the Rio-Colorado basin and the Great Lakes of North America, the countries have revised the treaties through the procedure of minutes, though it is not explicitly stated in the initial treaty.

## 7. UNIQUE PROVISIONS IN TREATIES

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### Senegal

Option for any coastal state to adhere to the Organization - (Article 22) - allowing for Guinea to join the OMVS at a later stage, which it subsequently did in 2006.



### Orange-Senque

Parties may establish Commissions governing any aspect of the river system, which will be subordinate to ORASECOM - (Article 1(1.4)).



### Mekong

In the event of substantial damage caused to riparian(s), concerned parties must determine cause, extent and responsibility for damage and resolve issues amicably - (Article 8).



### Danube

Protection of secret and confidential information supplied to contracting parties - (Article 13).



### Rhine

The Commission shall cooperate with other inter-governmental organizations whose work is related to the Convention - (Article 14).



### Great Lakes of North America

The International Joint Commission acts as a quasi-judicial body and has the power to administer oaths to witnesses, take evidence on oath whenever necessary and decide disputes between parties - (Article 12).



## Chapter 4 : Sharing and Utilization

---

This chapter specifically deals with sharing and utilization of water in terms of quantity and not quality. It identifies the manner of utilization of water and the different methods of sharing water within river basins outlined in theory and implemented in practice. The quality aspect of water management is addressed in the chapter on Environment.

After studying numerous treaties and agreements, it has come to light that the most common way to address the issue of water amongst countries is through the terms 'sharing' and 'utilization'. There are several types of sharing and utilization of water that occurs. These include the following:

### **Manner of Utilization**

- Equitable, Reasonable and Rational – these methods state that countries use waters without harming the interest of other riparian states. While the legal definition in each treaty might be a little different, operationally they convey the same thing and are followed in practice.

### **Methods of Sharing**

- Sectoral: in the case of Senegal, which is the only treaty under study which uses the phrase 'sectors of use', water is shared in specific amounts considering the future requirement of each sector in each country in the basin with a great level of transparency. This is different from other basins, because in most other cases water is shared by countries in agreed amounts without neighbours necessarily knowing what the water is used for.
- Formula: Allocation of water based on specific calculation of quantity, reasonable variability or even territorial boundaries.



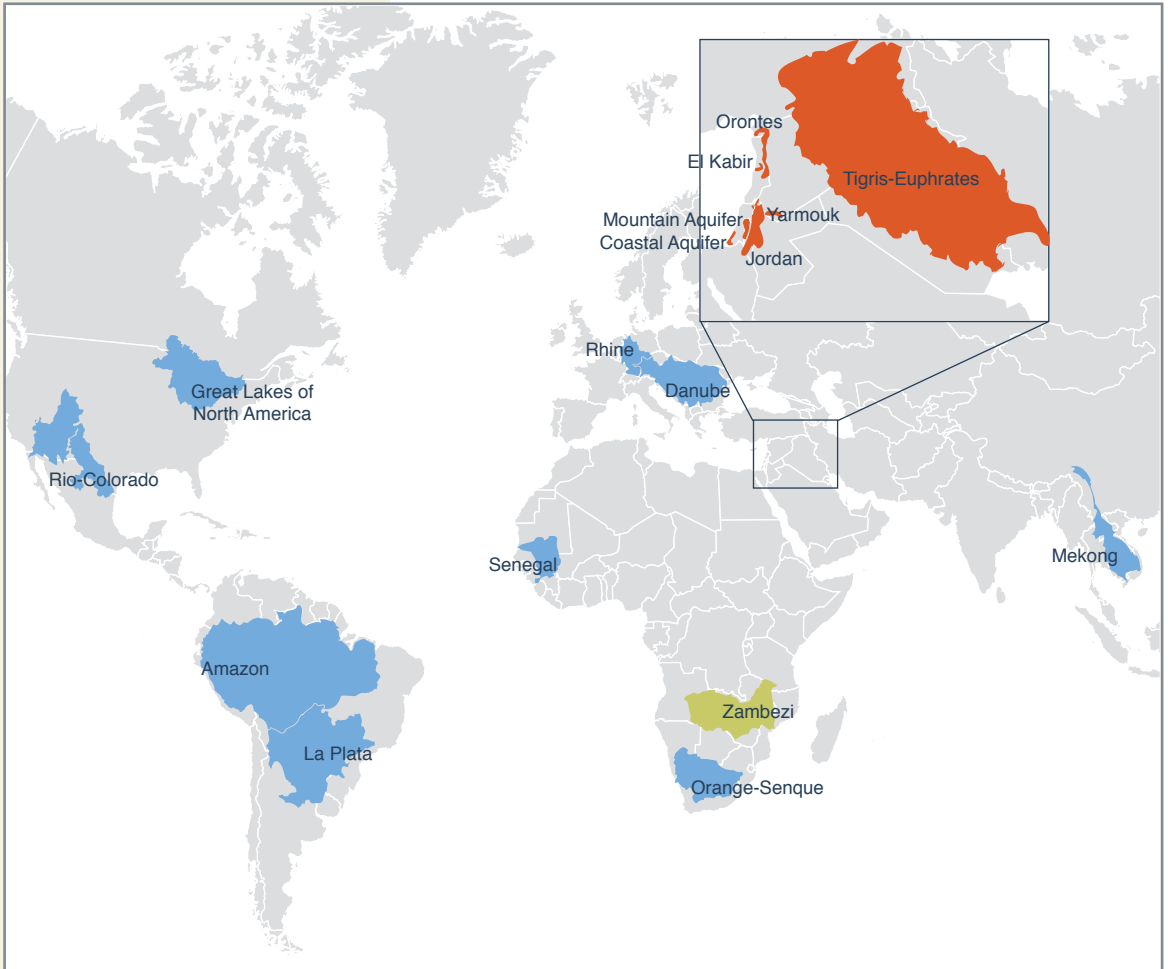
## 1. SHARING METHODS

River Basins	Manner of Utilization		Methods of Sharing of Water	
	Equitable/Reasonable	Rational	Sectoral	Formula
Senegal		■ ■	■ ■	
Zambezi	■			
Orange-Senque	■			
Mekong	■ ■			
Amazon		■ ■		
La Plata		■ ■		
Danube	■ ■			
Rhine	■ ■			
Rio-Colorado	■ ■			■ ■
Great Lakes of North America	■ ■			■ ■
Yarmouk				■
Jordan				■
Tigris-Euphrates				■
Orontes				
El Kabir	■			■
Mountain Aquifer				■
Coastal Aquifer				■

■ Intended Methods for Sharing and Utilization of Water Mentioned in Treaties/Agreements

■ Actual Methods for Sharing and Utilization of Water Being Implemented (in Practice)

## 2. SUCCESSFUL EXAMPLES



- Successful
- Unsuccessful
- In formative stage

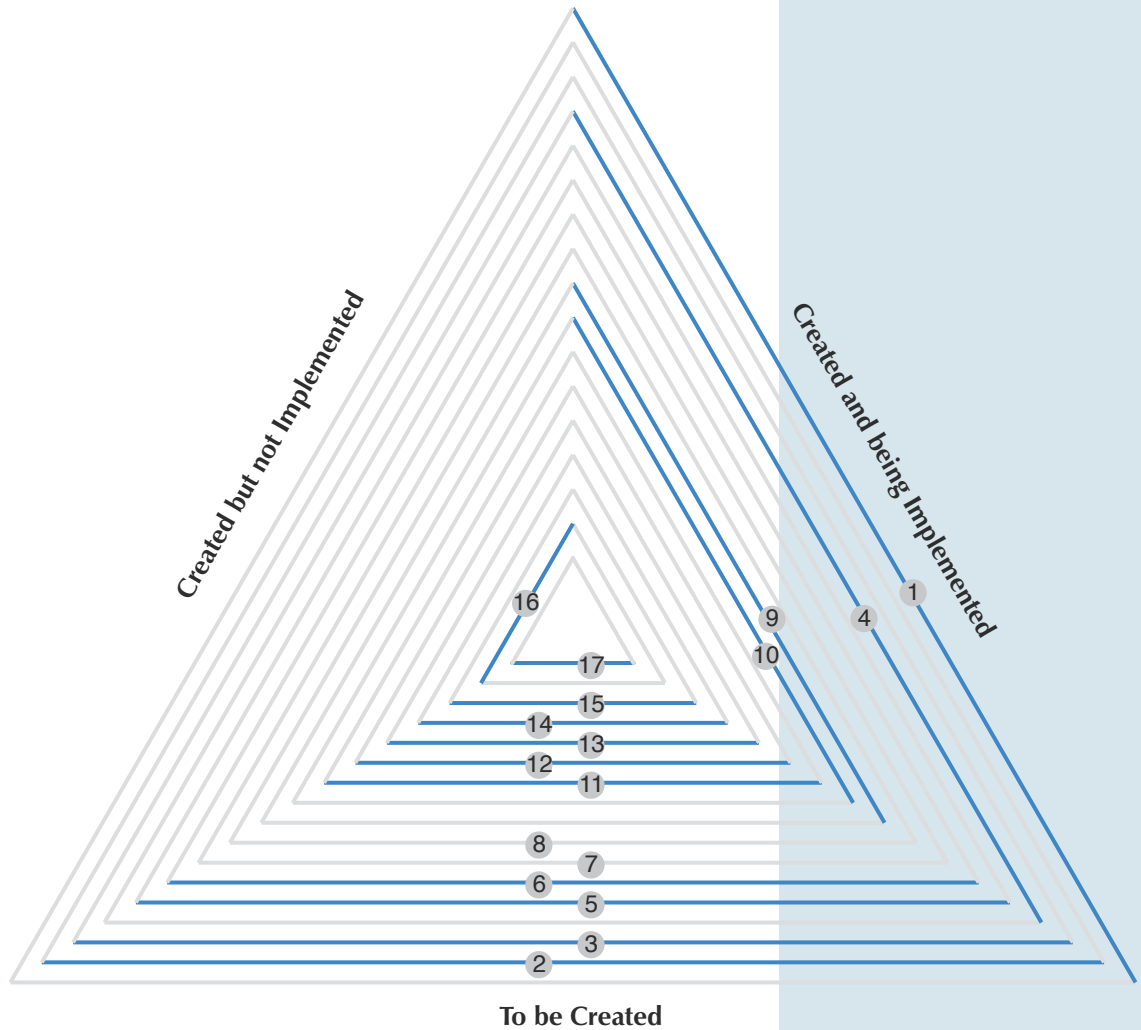
*Successful here means that the states in the river basins are actively cooperating to:*

- *Share waters in a manner agreed upon by them and/or;*
- *Utilize the waters in a manner that does not infringe upon the interests of other riparian states.*



### 3. GUIDELINES

Specific guidelines are often adopted or laid down by the states or the RBOs to complement the provisions relating to the sharing and utilization of water in a treaty or agreement, thus giving a nuanced approach to the entire process.

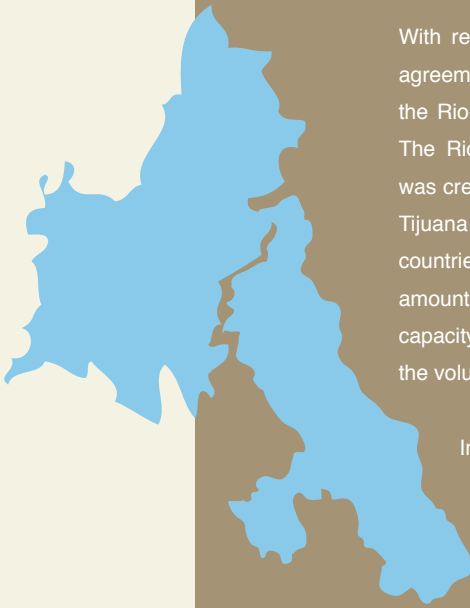


- |                 |                                 |
|-----------------|---------------------------------|
| 1 Senegal       | 10 Great Lakes of North America |
| 2 Zambezi       | 11 Yarmouk                      |
| 3 Orange-Senque | 12 Jordan                       |
| 4 Mekong        | 13 Tigris-Euphrates             |
| 5 Amazon        | 14 Orontes                      |
| 6 La Plata      | 15 El Kabir                     |
| 7 Danube*       | 16 Mountain Aquifer             |
| 8 Rhine*        | 17 Coastal Aquifer              |
| 9 Rio-Colorado  |                                 |

*\*The Danube and Rhine River basin agreements deal mainly with the quality management of the rivers and not on quantity allocation.*



## Revising a Treaty: Rio-Colorado River Basin



With regard to water sharing and utilization, none of the existing agreements or treaties of the 10 river basins studied - apart from the Rio-Colorado Treaty - have been revised since their inception. The Rio-Colorado Treaty between the United States and Mexico was created in 1944, and focused on the utilization of the Colorado, Tijuana and Rio Grande waters. In November 2012, the two countries signed a new agreement addressing changes in the amount of water being shared and fresh ways to use their storage capacity, primarily due to recent weather changes and changes in the volume of available water.

Interestingly, the Rio-Colorado River Basin has a contingency plan for special circumstances, such as extreme drought or accidents. In times like these, either country may decrease the amount of water to be discharged, thereby altering the flow to the other side.

## Chapter 5 : Data Management

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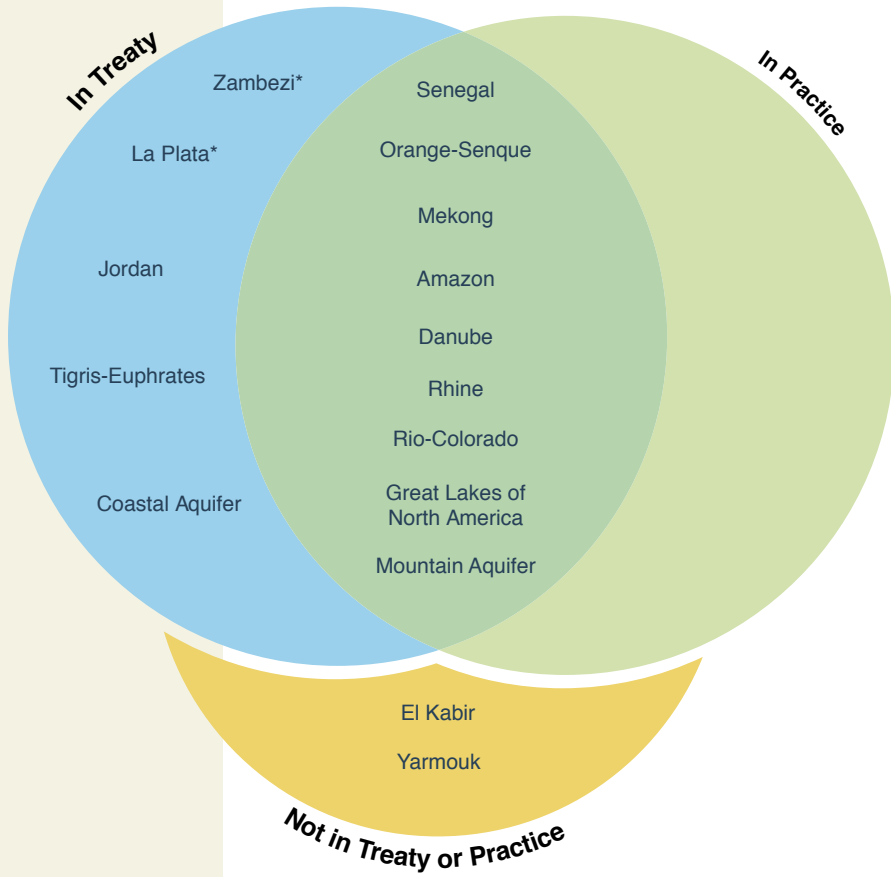
Joint and integrated management of trans-boundary watercourses requires sustained monitoring of the basin, collection of data and its exchange amongst riparian nations. A detailed analysis of this process which occurs in the river basins and contributes towards the successful management of the basin is given in this chapter.

There are various forms of data that are usually collected with the most common being the level of flow of the water. However, most river basins also collect data with respect to the quality of water, pollution level and floods. The manner in which the data is collected and exchanged differs across basins. For example in some basins the data is collected by the River Basin Organizations, while in some the data is collected by the states. River Basin Organizations also act as repositories of information collected by the state, as well as facilitators in the exchange of such information. The exchange of data is done on a regular basis in most basins.

Monitoring of the river basins is usually done basin wide. In a few cases it is done at the national level and the data is shared with other riparians. Each basin has monitoring stations set up to acquire information related to different aspects of the shared water body which includes level and quality of surface and ground water, hydro power potential, ecology and impact of climate change.



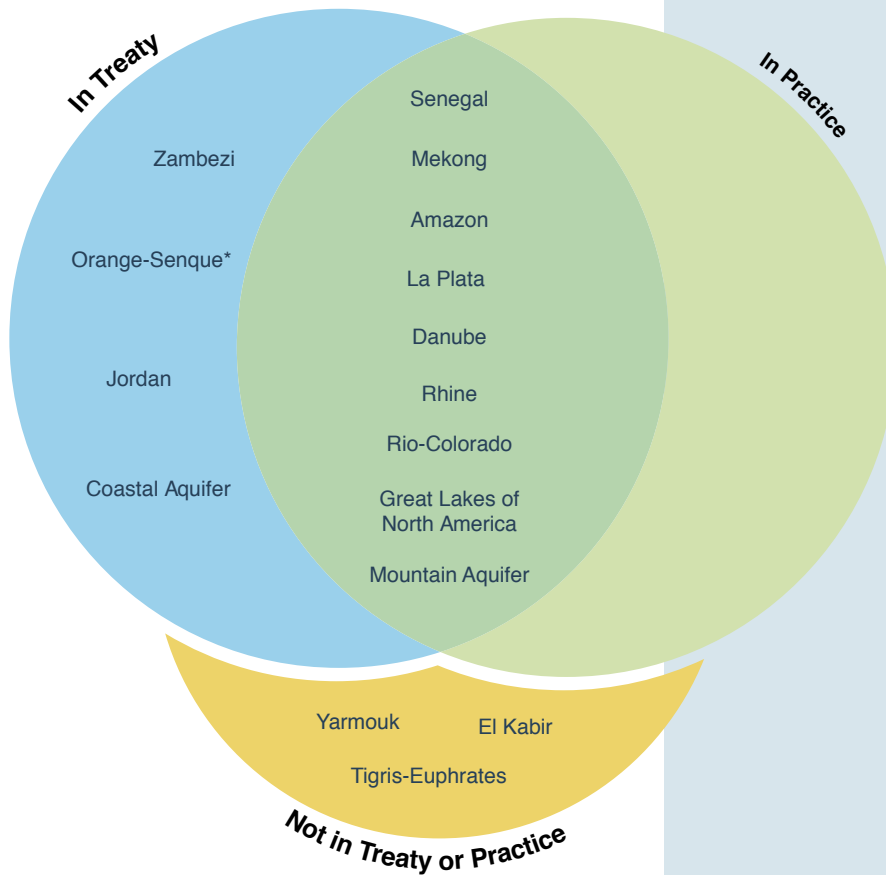
## 1. DATA COLLECTION AND MONITORING



\* In formative stage

Note: Information on Orontes not available.

## 2. EXCHANGE OF INFORMATION



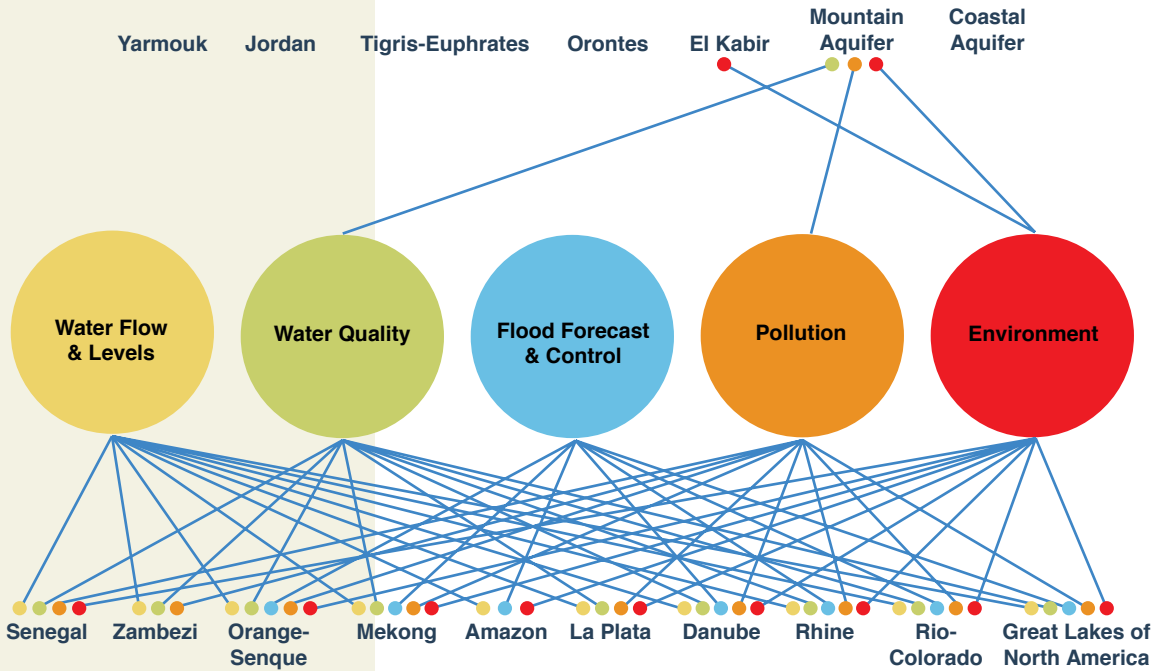
*Mountain Aquifer - In Practice: minimal amount of data is exchanged which is highly contested.*

*Orontes - Data is not available*

*\* In formative stage*



### 3. TYPES OF DATA COLLECTION



#### Kind of Monitoring

- Senegal — Eutrophication and chemical pollution
- Zambezi — Eutrophication
- Orange-Senque — Salinity, Atmospheric, Groundwater
- Mekong — Fisheries
- Amazon — Deforestation, Land use changes, Transported material
- Danube — Groundwater
- Rhine — Ecology
- Great Lakes of North America — Air, Weather, Salinity

## 4. MONITORING STATIONS

✓ Monitoring taking place

✗ Monitoring not taking place

With the exception of the Orange-Senque river basin and the two basins in Latin America, the following table shows us that monitoring for various types of information is done basin wide. In the Orange-Senque basin, monitoring is done at the country level and the information is then shared on a common web based platform with the other riparian states. This web based platform is currently being evaluated and is likely to be upgraded. In both the La Plata basin and Amazon basin, the National Water Agency of Brazil does most of the monitoring as they have advanced systems set up for this, but it is done for the whole basin and shared with all riparian countries.

### Senegal



#### Senegal River Basin Monitoring Activity (SRBMA)

Hydrological and environmental

#### Department of the Environment and Sustainable Development

For impact assessment of infrastructure development

### Zambezi



#### Hydroelectric Hydrological Assistance Project

Hydropower development and operations

#### Zambezi River Authority

Forecasting inflows in Lake Kariba and scheduling dam operations; Pollution and water control on Zambezi and tributaries

#### Zambezi Water Information System (ZAMWIS part of ZAMCOM)

Hydrological, meteorological, socio-economic, water use and environmental

### Orange-Senque



#### Botswana:

#### Department of Water Affairs (DWA), Department of Geological Survey (DGS) District Councils and SADC

Water quality in boreholes, groundwater levels, chloride concentrations in rainfall, and soil moisture content

#### Lesotho:

#### Lesotho Highlands Development Authority

Hydrology, habitat, water quality, riparian vegetation, macro-invertebrates and fish

#### The Groundwater and Water Pollution Control Divisions of DWA

Monitors groundwater abstraction and water quality, groundwater exploration, management and resource assessment at national and district level.

#### Hydrogeology Section, DWA

Monitors wells

#### Water And Sewage Authority (SADC)

Monitors well discharge rates



**Namibia:****Department of Water Affairs and NamWater**

Rainfall and stream flow

**National Groundwater Monitoring Programme**

Groundwater wells

**South Africa:****Department of Water Affairs (DWA)**

Stream flow

**National Chemical Monitoring Programme (NCMP)**

Chemical water quality of surface waters

**National Eutrophication Monitoring Programme (NEMP)**

Water quality and bio-diversity

**National Microbiological Monitoring Programme (NMMP)**

Faecal pollution

**National Aquatic Ecosystems Health Monitoring Programme (NAEHMP)**

Ecological (fish, invertebrates, vegetation)

**Regional Remote Sensing Unit**

Agro-meteorological data

**Drought Monitoring Centre**

Meteorological, environmental and hydrological-meteorological

**Mekong****MRC Data and Information Services Portal**

Water level, water quality, fisheries, hydro-meteorology, hydro power, irrigation, river bio-monitoring, climate change and adaptation, Geo-spatial information (satellite imageries)

**Amazon****ANEEL (Brazilian Electricity Regulatory Agency)**

Water flow volume, transported materials

**Hydrometric Basic Network by Brazilian National Water Agency ANA**

Hydrological and sediment load

**National Institute for Space Research (INPE, Brazil)**

Amazon Deforestation Monitoring Project

**La Plata****The National Water Agency (Brazil)**

Water quality monitoring stations

**U.S. Geological Survey (USGS)**

Surface and ground water, water quality, precipitation, stream flow



## Danube



### Trans National Monitoring Network (TNMN)

Quality and pollution on chemical, biological and microbiological

## Rhine



### International Commission for the Hydrology of the Rhine Basin

Flood control, sedimentation, hydrological forecasts, climatic changes

### International Main Alert Centres

Noxious substances harmful to water quality

## Rio-Colorado



### International Water and Boundary Commission

Surface and ground water, metals, sediments, chemical, biological and salinity

## Great Lakes of North America



### Great Lakes National Program Office

Water, aquatic life, sediments, limnology, air

### Integrated Atmospheric Deposition Network

Toxic pollutants

## Yarmouk



## Jordan



## Tigris-Euphrates



## Orontes



*Suspended*

## El Kabir



## Mountain Aquifer



### Supervision and Enforcement Team of the Joint Water Committee

Water and Sewerage level and extraction potentials of the aquifers

## Coastal Aquifer



## 5. FREQUENCY OF DATA COLLECTION AND MONITORING

River Basins	Frequency of Collection and Monitoring
Senegal	
Zambezi	
Orange-Senque	Information Systems developed by ORASECOM allows access of some information
Mekong	Dry season – daily information on descending water levels Wet Season – daily information during floods in Lower Mekong Basin Data every 15 minutes along Mekong tributaries
Amazon	
La Plata	
Danube	Minimum sampling is 12 times a year for chemical determinants and 2 times a year for biological parameters. Regular collection for flood control, pollution, joint modelling systems
Rhine	Information exchanged through International Commission for the Hydrology of the Rhine basin
Rio-Colorado	Rio Grande water flows are updated daily, Monday to Friday at the same time every day
Great Lakes of North America	Regional Data Exchange conferences and workshops (held every six months) bring together decision makers, data experts and stakeholders to develop a common vision on the Great Lakes
Yarmouk	
Jordan	
Tigris-Euphrates	
Orontes	Suspended
El Kabir	Unclear
Mountain Aquifer	
Coastal Aquifer	



No Monitoring



Data Unavailable

## 6. METHODS AND PROCESSES

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### Senegal

High Commissioner collects data from Member States and submits it to the Council of Ministers

### Zambezi

Member States provide data to other Member States and the Secretariat

### Orange-Senque

Parties exchange information while the Council provides advice and recommendations

### Mekong

Joint Committee obtains updates and exchanges data and information. Secretariat maintains the databases of information

### Amazon

Permanent exchange of information amongst members

### La Plata

Plan recently developed by the Commission (*unclear when it will come into effect*)

### Danube

Parties exchange data on river conditions, research, best practices and development

### Rhine

Working groups collect and evaluate the data

### Rio-Colorado

Country Commission maintains record of the respective waters; Government exchanges information on water discharges and flood flows

### Great Lakes of North America

Governments submit information to IJC which collates, analyses and disseminates

### Jordan

Israel and Jordan are to exchange data on water resources through the Joint Water Committee, though the frequency of these exchanges is unclear

### El Kabir

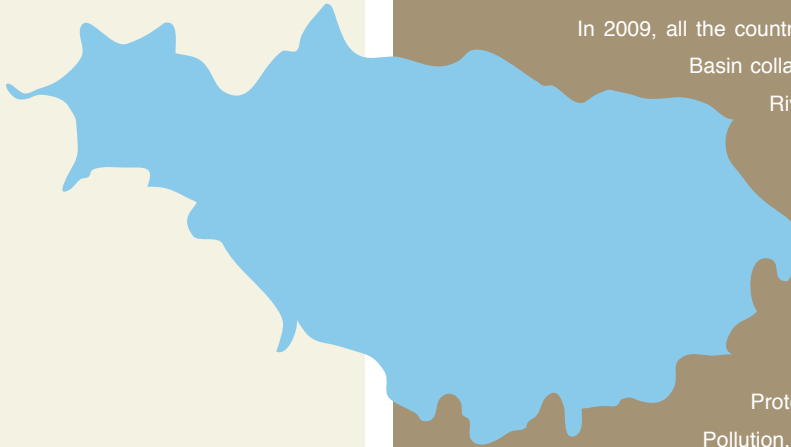
Irregular exchange only at the technical level

### Mountain Aquifer

Joint Supervision and Enforcement teams collect data on each side, though the frequency of exchange is unclear



## Creating Basin Wide Maps: Danube River Basin



In 2009, all the countries within the Danube River Basin collaborated to build the Danube River Basin Management Plan. The purpose of the plan is to create means to achieve *at least good status* by 2015 and thematic maps. The maps cover a diverse range of subjects such as Ecoregions, Protected Areas, Nutrient Pollution, Chemical Status of Water Bodies, Urban Wastewater Discharge, River and Habitat Continuity Interruption, Transnational Monitoring Network for Surface Waters, Wetlands/Floodplains with Reconnection Potentials and Expected Improvements, Delineated Surface Water Bodies, Future Infrastructure Projects and Hydrological Alternations comprising Impoundments, Abstractions and Altered Flow Regime. In December 2009, the International Commission for the Protection of the Danube River adopted this Plan.

The concept of thematic maps is unique to this river basin in contrast to other basins that simply map out their independent territories and information. A basin wide map provides a thorough and detailed perspective of various occurrences across all the countries. This regional approach is an example of water collaboration and cooperation across a river basin using a collective approach.

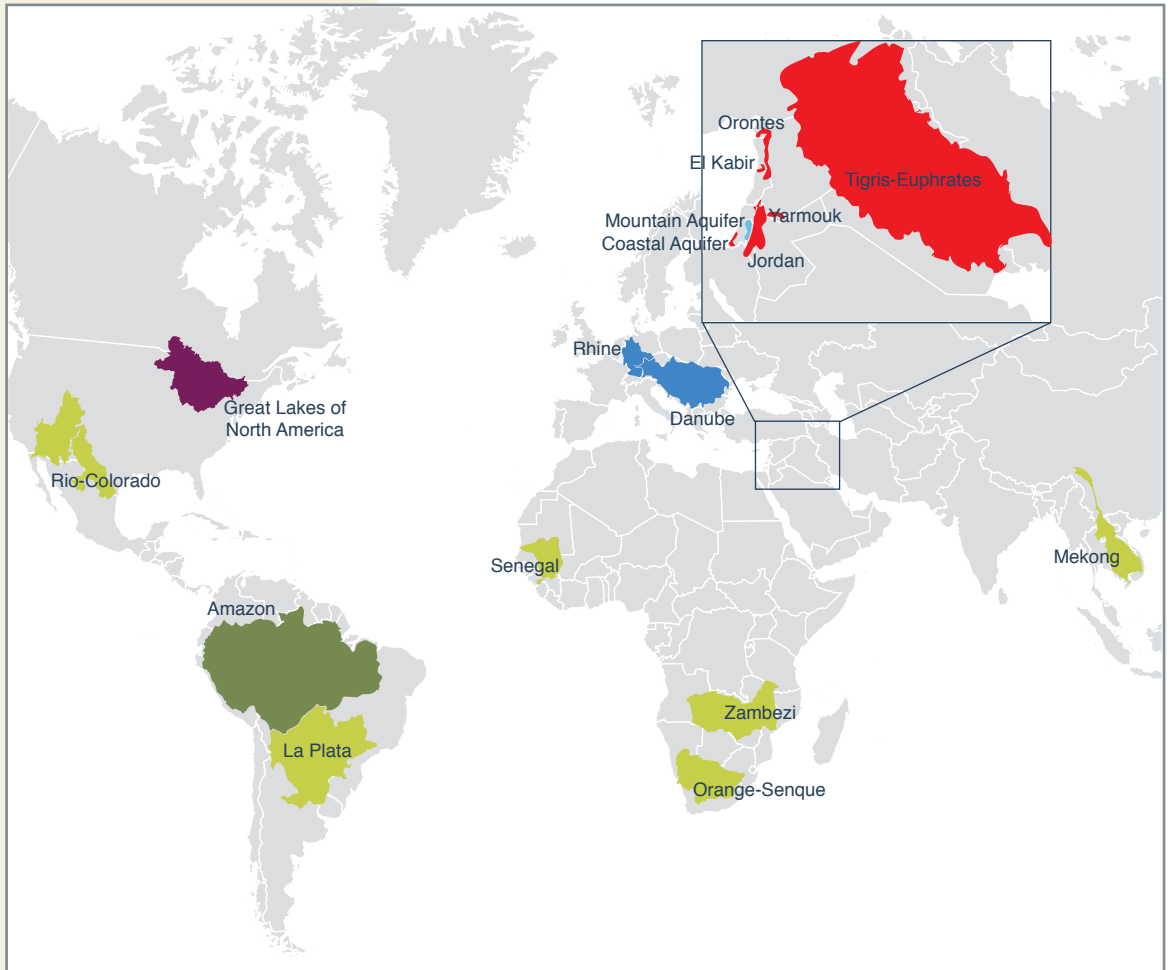
## Chapter 6 : Environment and Climate Change

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All the environment and climate change related programmes, including those that are still under discussion or proposed, addressed in this section are those done on a basin wide level either by the River Basin Organization or an authority created by the organization. Proposed plans are also included in some cases, such as the ZAMCOM, which is still in the process of creating an institution to deal with all aspects of integrated management, but they indicate a level of understanding and cooperation on the issue. In the case of climate change programme especially, many programmes are new, as this is a subject that organizations have only begun to examine over the last few years.



## 1. ENVIRONMENT PROGRAMMES



- Environmental Impact Assessment
- Forests, Bio Trade, Tourism
- River Protection
- 'Zero Discharge' of Toxic Pollutant
- Waste Water Treatment
- No Programs Undertaken / Implemented

## 2. KEY ENVIRONMENTAL ISSUES

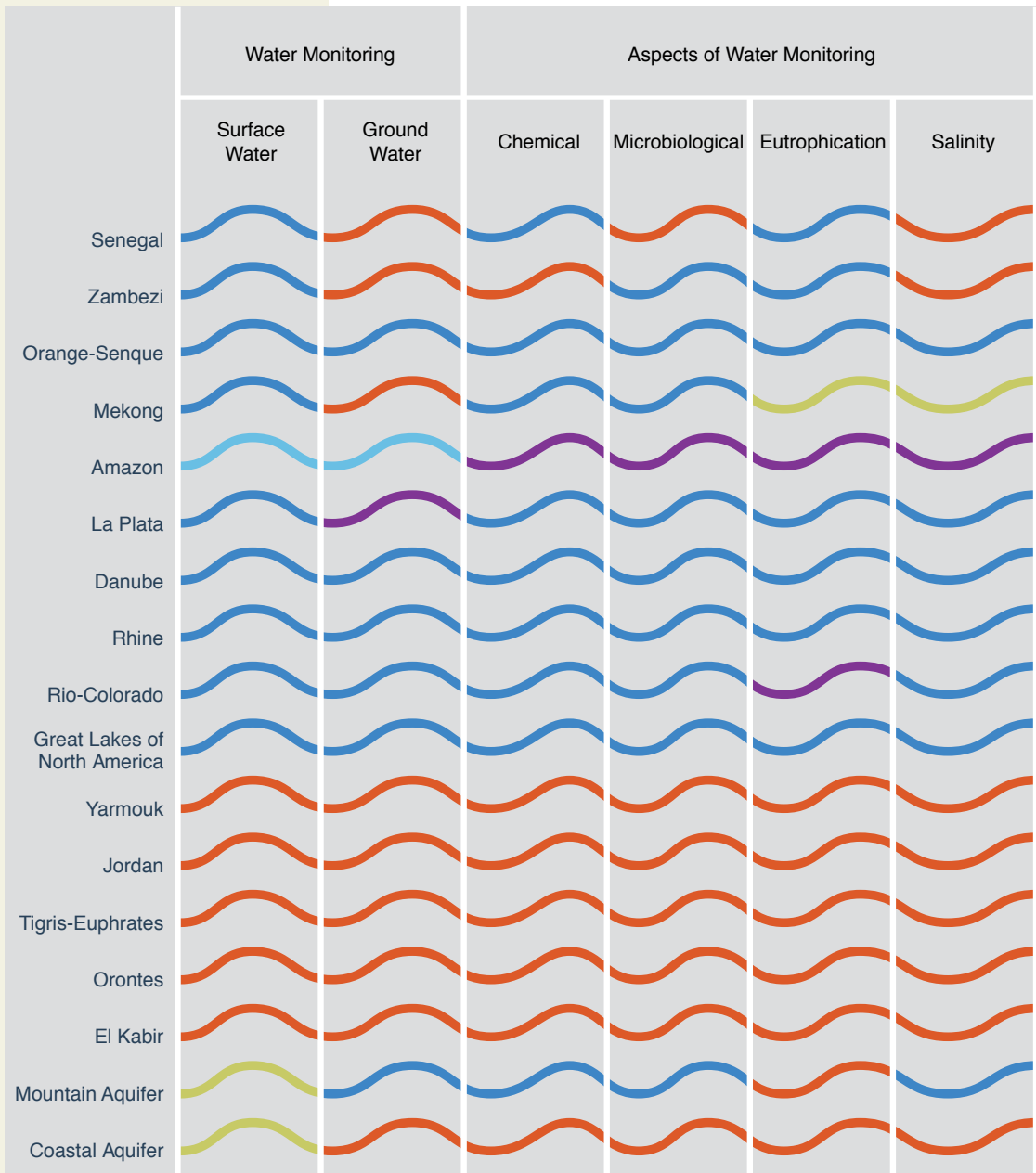
River Basins	Water Pollution Prevention	Salinity	Flood Management	Drought Management	Soil Erosion	Sedimentation	Desertification	Land Degradation	Invasive Species Control
Senegal	■	■	■	■	■	■	■	■	■
Zambezi	■	■	■	■	■	■	■	■	■
Orange-Senque	■	■	■	■	■	■	■	■	■
Mekong	■	■	■	■	■	■	■	■	■
Amazon	■	■	■	■	■	■	■	■	■
La Plata	■	■	■	■	■	■	■	■	■
Danube	■	■	■	■	■	■	■	■	■
Rhine	■	■	■	■	■	■	■	■	■
Rio-Colorado	■	■	■	■	■	■	■	■	■
Great Lakes of North America	■	■	■	■	■	■	■	■	■
Yarmouk	■	■	■	■	■	■	■	■	■
Jordan	■	■	■	■	■	■	■	■	■
Tigris-Euphrates	■	■	■	■	■	■	■	■	■
Orontes	■	■	■	■	■	■	■	■	■
El Kabir	■	■	■	■	■	■	■	■	■
Mountain Aquifer	■	■	■	■	■	■	■	■	■
Coastal Aquifer	■*	■*	■	■	■	■	■	■	■

\*There are joint cooperative efforts to tackle pollution and salinity, though there is no formal mechanism for cooperation in this aquifer.

- Considered
- Proposed
- Not considered
- Not relevant
- Data not available



### 3. QUALITY CONTROL

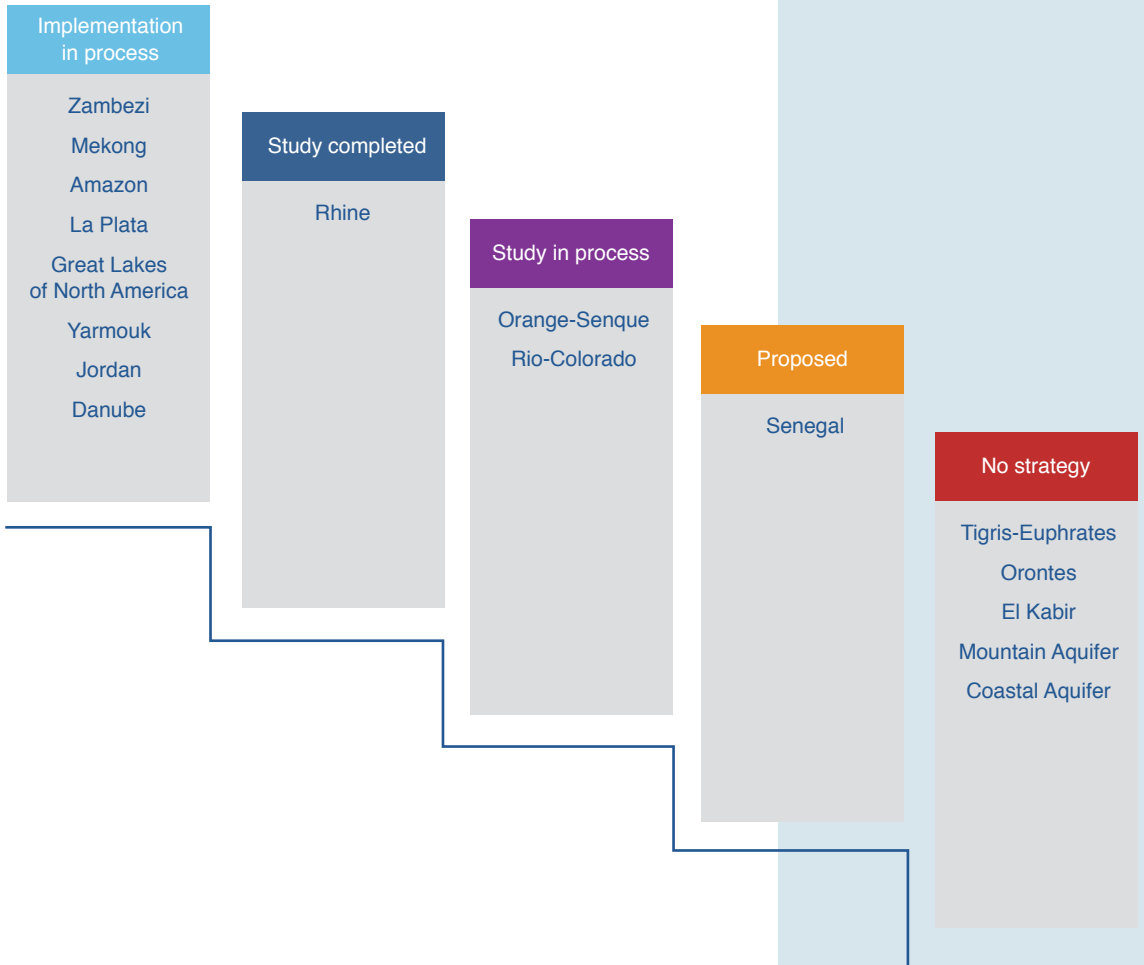


- Monitored
- Proposed
- Not monitored
- Not relevant
- Data unavailable

*The ICPR (Rhine Basin) has developed a Warning and Alarm System to prevent extreme pollution. In case of an accident, a warning is issued by the seven operating international warning centres by fax and telephone to the other downstream warning centres for rapid action.*



## 4. CLIMATE CHANGE STRATEGY



## 5. COLLABORATION WITH THIRD PARTIES

### Basin

#### Project

Aim

Third Party Regional / International Agencies

### Senegal

#### Senegal River Basin Water and Environmental Management Programme

To provide a participatory, strategic framework for the environmentally sustainable development of the Basin

World Bank/UNDP

### Zambezi

#### Joint Zambezi River Basin Environmental Flows Programme (EF ZRB)

To sustain freshwater and estuarine ecosystems and human livelihoods that depend on these ecosystems

SADC

### Orange-Senque

#### GIZ/BMZ/AusAid/DFID Programmes

To help manage environmental flows and address climate change

GIZ/BMZ/AusAid/DFID

### Mekong

#### Basin Development Plan

Prioritizing environment, social sustainability, climate change adaptation strategies

SDC

### Amazon

#### Special Commission of the Amazon Region on the Environment Strengthening the Joint Regional Management for the Sustainable Use of the Amazonian Biodiversity

Conservation and sustainable development of Amazonian bio-diversity

UNDP, GEF

## La Plata

### **Sustainable Management of water resources with Respect to the Hydrological Effects of Climatic Variability and Change**

To provide for the integration of international waters, especially biodiversity, and land degradation

UNEP, OAS/OSDE

## Danube

### **Danube Regional Project**

Protection of international waters, sustainable management of natural resources and biodiversity

UNDP, GEF

### **EnviroGRIDS Project**

To improve the information management, observation and assessments systems for the Danube and the Black Sea

UNEP

## Rhine

Internal river basin programs

## Rio-Colorado

Not relevant to the river basin

## Great Lakes of North America

Not relevant to the river basin

## Yarmouk

No collaboration with third parties

## Jordan

To produce a regional master plan for the Lower Jordan

World Bank



## Tigris-Euphrates

No collaboration with third parties

## Orontes

No collaboration with third parties

## El Kabir

Sustainable Development of the Akkar Watershed of Syria and Lebanon

Arab Water Council, Cida

## Mountain Aquifer

Al Bireh Waste Water Treatment Plants

Purification of domestic waste water

KFW

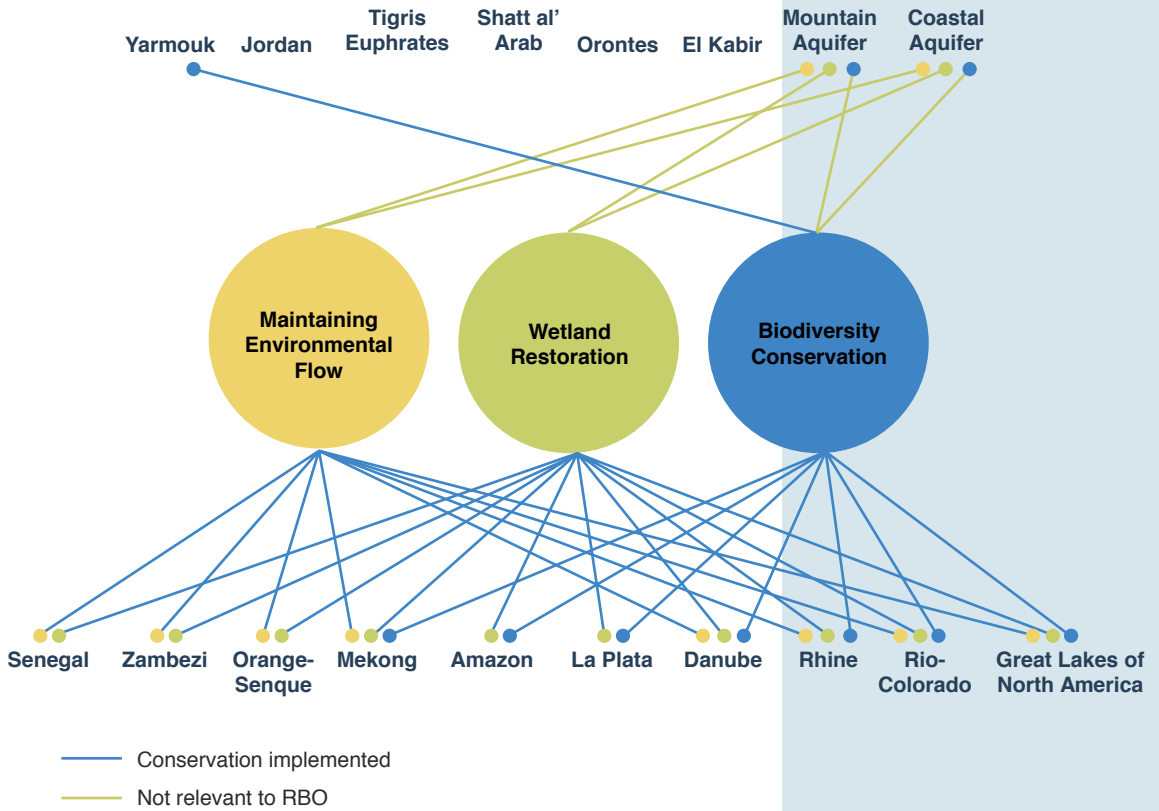
## Coastal Aquifer

USAID MERC Project

To develop empirical quantitative estimates of sea water intrusion

USAID

## 6. CONSERVATION



Environmental Flow Management is defined as the amount of water that needs to be left in the river system (after withdrawals for diverse uses), or the amount of water that needs to be returned to the river (through releases from dams or through inter-basin transfers) to sustain freshwater and estuarine ecosystems and livelihoods that depend on these ecosystems.



## 7. SUSTAINABLE DEVELOPMENT

### Basin-wide Activities Related to Sustainable Development and Livelihood Programmes

- Yes
- No
- Data not available

**Senegal**

Agriculture, livestock, mining, fishing, industrial activities

**Danube**

Joint Action Programme for agricultural and industrial water protection measures

**Great Lakes of North America**

International Red River Board bi-national scientific survey for fish health in the Devils Lake and Red River basin

**Mekong**

Agriculture, irrigation, fisheries management program

**Rhine**

Salmon 2020 program to sustain Salmon fish population

**Orontes**

Common irrigation practices – project suspended

**Amazon**

Promotion of trade, investments and exchange for BioTrade initiatives in the sectors: food, health, fashion and beauty recreation, tourism, biodiversity

**Rio-Colorado**

Rio Grande Basin Initiative - to improve agriculture through efficient irrigation and water conservation

**La Plata**

Forestry development project and hydrological determinants of agriculture in Latin America: Remote Sensing and numerical simulation project to improve agriculture and crop yields

**El Kabir**

Small scale programmes have existed in the past but unclear if any continue to work

**Yarmouk** **Jordan**

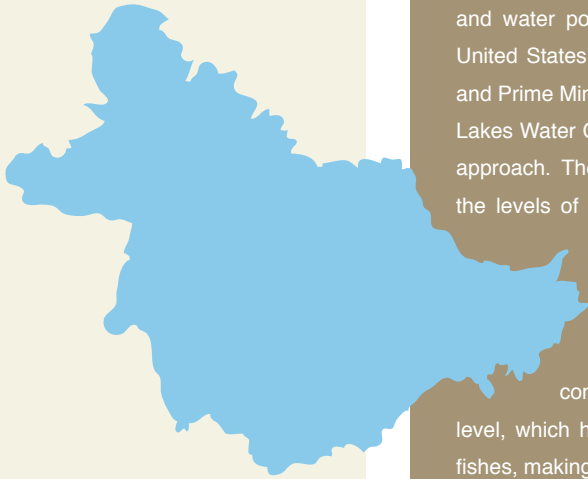
**Zambezi** **Orange-Senque** **Coastal Aquifer**

**Tigris Euphrates** **Mountain Aquifer**

No activity in terms of sustainable development

Infrastructure related planned development like construction of dams, dykes, flood management, reservoirs leads to **significant modifications in the environment** of the river basin. These modifications impact the **socio-economic** aspects of the population which are widely dependent on the environment of the basin. Depending on the physical characteristics and **economic potential** of the various basins, major production activities of the river basin population can be **agriculture, livestock, fisheries, mining and artisanal**. It is for these reasons that socio-economic characteristics for livelihood are **integrated** in the environmental planning and management. With a large population using the river water for agriculture, irrigation and fishing activities among others, River Basin Organizations or riparian states tend to **support livelihood development**. These programs or initiatives aim to **improve management** of the activities and **promote community involvement** in the **development process**.





## Great Lakes Water Quality Agreement Saves Lake Erie

With high levels of phosphorus causing massive algal blooms, the world's tenth largest lake, Lake Erie was declared 'dead' in the 1960s. Growing public concern over the environment and water pollution of the lake prompted Canada and the United States to act. In 1972, President Richard Nixon (US) and Prime Minister Pierre Trudeau (Canada) signed the Great Lakes Water Quality Agreement that undertook a coordinated approach. The agreement emphasized the need to reduce the levels of phosphorous entering lakes Erie and Ontario, and in 1977 a detail on the accepted levels of phosphorous was added to the Agreement.

Also, the use of phosphorus in detergents was banned. Lake Erie now has phosphorus content well below the maximum permissible level, which has resulted in the revival of native plants and fishes, making it a popular destination for tourism and fishing.

In 1978, the Agreement was revised and an 'ecosystem approach' in addressing human health and environmental quality issues was introduced. Since its implementation, the Agreement has been revised three times, the latest being in 2012 to better identify, manage and prevent current and emerging environmental issues affecting the Great Lakes.



### Bringing Back the North Aral Sea

The Aral Sea is an internationally known example of environmental mismanagement and is often regarded as one of the worst environmental disasters. Spread over 68,000 sq kms, the basin is surrounded by Kazakhstan, Kyrgyzstan, Tajikistan, Turkmenistan, and Uzbekistan. Formerly one of the four largest lakes in the world it has been steadily shrinking since the 1960s, after the former Soviet government diverted the two rivers feeding the Aral Sea, as part of its irrigation projects. The Sea lost three quarters of its volume, half its surface area and the shoreline retreated by 100 km.

In 2001, the Kazakhstan government with the help of World Bank launched a rescue project to bring back the North Aral Sea, which falls in its territory. Water level rose by 30% following construction of a dyke, mending of leaking irrigation channels and increasing the flow of water from Syr Darya River into the Aral Sea. This has also positively impacted the ecology, with the Aral Sea now hosting 15 different species of fish, plants and birds. The Southern Aral Sea however continues to shrink as outflows from the Sea surpass inflows. The International Fund for Saving the Aral Sea (IFAS) and other restoration projects are working towards finding ecological solutions for the South Aral Sea.



## Chapter 7 : Dispute Resolution Mechanisms

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Dispute Resolution Mechanisms focus on the engagement of shared riparians through various means including diplomatic and legal, to resolve disputes affecting the development or co-operation within the river basin. This chapter offers a comparative analysis of the different methods adopted by the riparians towards the resolution of their disputes. These methods range from consultations, mediation and negotiation to judicial means such as approaching the International Court of Justice or the SADC tribunal. In some cases, the River Basin Organizations become a means to resolve differences or disputes between state parties.

This chapter also provides details and examples of the common reasons which become a bone of contention amongst the riparians. For example the utilization of water resources and the diversion or disruption of the flow of water as a result of the construction of structures on the water body is often seen to cause differences between riparian nations. In such cases the states have mostly resorted to the peaceful means of settlement of disputes rather than letting it escalate to a level of an armed conflict.

There is also a focus on the mechanism to avoid or prevent any dispute which may arise while undertaking any planned measure in the river basin. This is referred to as 'Principles of Notification and Consultation'. Thus a dispute that may arise out of the construction of a dam by a riparian which may hamper the flow of the river and harm another riparian may be avoided altogether by introducing and following the dispute avoidance mechanism mentioned here.



## 1. TYPES OF DISPUTE RESOLUTION MECHANISMS

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“Dispute” refers to any disagreement that leads to contention amongst riparian states, which in turn threatens to adversely affect planned development of the basin or the efficient functioning of the River Basin Organization or Commission.

**River Basin** ● **Disputes can be referred to**  
Disputes can be resolved by

**Senegal** ● **International Court of Justice (as a last resort)**  
Conciliation or Mediation

**Zambezi** ● **SADC tribunal**  
Consultations and Negotiations

**Orange-Senque** ● **SADC tribunal**  
Consultations or Negotiation

**Mekong** ● **Council or Joint Committee**  
Diplomatic channels or third party Mediation

**Amazon** ● **Organization of American States**  
Diplomatic Processes

**La Plata** ● **Organization of American States**  
Diplomatic Processes

**Danube** ● **International Court of Justice**  
Negotiation or Arbitration

Rhine	●	International Court of Justice Negotiation or Arbitration
Rio-Colorado	●	Commission → Respective Governments Diplomatic Processes
Great Lakes of North America	●	Commission → Respective Governments → Umpire (Neutral expert)
Yarmouk	●	
Jordan	●	Negotiation or Conciliation or Arbitration
Tigris-Euphrates	●	
Orontes	●	
El Kabir	●	
Mountain Aquifer	●	Joint Water Committee Negotiation or Conciliation or Arbitration
Coastal Aquifer	●	Negotiation or Conciliation or Arbitration

## 2. TYPES OF DISAGREEMENTS

	Using of Water Resources	Construction of Dams, Canals and Wells	Diversion of River	Disruption of Water Flow	Monetary
Senegal	★	★	○	○	○
Orange-Senque	○	○	○	○	○
Mekong	○	○	○	○	○
Amazon	○	○	○	○	○
La Plata	○	★	○	○	○
Danube	★	○	○	○	○
Rhine	○	○	○	○	★
Rio-Colorado	★	○	○	★	○
Great Lakes of North America	★	○	○	○	○
Yarmouk	○	○	○	○	○
Jordan	○	○	○	○	○
Tigris-Euphrates	○	○	○	○	○
Orontes	○	○	○	○	○
El Kabir	○	○	○	○	○
Mountain Aquifer	○	○	○	○	○
Coastal Aquifer	○	○	○	○	○

- Disagreement that exists
- Issue has not raised any concerns amongst member states
- ★ Previous disagreement has been resolved
- Not a cause for concern
- Data is not available

ZAMCOM is currently in transition and has an interim commission in place. As a result, the scope of disagreements is hard to determine.



### 3. PAST AND PRESENT DISPUTES

#### Diversion of River Water

**When:** Hungary against Slovakia 1980 - present

**Concern:** Gabčíkovo-Nagymaros Hydro Power Plant; Hungary objected to the diversion of Danube and environmental degradation

**Addressed by:** International Court of Justice

**Outcome:** Ruling against Hungary's objections; both countries asked to negotiate. Hungary refused to abide. The project stands partially complete from Slovakia's side

#### Environmental and Social Impact

**When:** Vietnam and Cambodia against Laos  
2010 - 2013

**Concern:** Xayaburi Dam project  
Fishing and socio-economic development concerns for the Lower Mekong region

**Addressed by:** Mekong River Commission Council

**Outcome:** Laos claims to have amended its plan to accommodate concerns. Dam construction continues; worries exist

#### Construction of Dams & Canals

**When:** Argentina, Brazil and Paraguay  
1977 - 1979

**Concern:** Corpus-Itaipu Dam Construction of Itaipu Dam affecting Parana River water flow

**Addressed by:** Heads of Government through negotiations

**Outcome:** Corpus-Itaipu Tripartite Agreement with technical specifications addressing water flow

#### Environmental Degradation

**When:** Argentina - Uruguay 2005 - 2010

**Concern:** Pollution of Uruguay River by pulp mill

**Addressed by:** International Court of Justice

**Outcome:** Setting up of a joint environmental monitoring program

## Financial Contribution

**When:** Netherlands against France 1998 - 2004

**Concern:** Protection of the Rhine from pollution by chlorides. Financial contribution by Netherlands to the reduction of chloride discharges into the Rhine River

**Addressed by:** The Arbitral Tribunal

**Outcome:** France is obliged to pay the Netherlands EUR 18 million

**When:** Paraguay against Brazil  
1984 - 1985, 2008 - 2009

**Concern:** Energy price

**Addressed by:** Heads of Governments through negotiations

**Outcome:** Brazil increased its annual payment to Paraguay for power from the dam from \$120 million to \$360 million

## Allocation of Water and Measurement of Water

**When:** USA – Mexico 2002

**Concern:** Lower Rio Grande Valley. Allocation and management of river water from Mexico to the US during 'drought' period

**Addressed by:** US and Mexico governments

**Outcome:** Agreement on a variety of short-term measures. Mexico agreed to make an immediate transfer of water in the Falcon/Amistad system to the US and the US agreed to co-operate with Mexico in case of insufficient rainfall

## Design Parameters of Dams and Reservoirs

**When:** USA (Seattle City Light) - Canada (British Columbia) 1969-1982

**Concern:** Skagit/Ross Dam. Environmental impact on the water body areas on both sides. Raising the dam's height would flood the Skagit Valley on Canadian side

**Addressed by:** Committee of the IJC through negotiations

**Outcome:** British Columbia-Seattle Agreement and Skagit River Treaty. Establishment of the Skagit Environmental Endowment Commission (SEEC) to manage the environment in the Upper Skagit Watershed until 2065.

Seattle City Light agreed not to raise Ross Dam for 80 years in exchange for power purchased from British Columbia at rates equivalent to what would have resulted from raising the dam.



## 4. NOTIFICATION, CONSULTATION AND NEGOTIATION

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Principles of Notification and Consultation (and negotiation) recognized under international law forms an integral part of trans boundary water resources management. It helps in preventing states from undertaking any unilateral measures that will hurt the interest of other states. The unilateral measures could be in the form of any planned measure undertaken in the territory of a riparian nation. Under this principle a state undertaking measures that may cause harm to others must give prior notice to other states that may be affected by such measures. The state must, when required, also enter into consultations and negotiation with parties that may be affected in order resolve the issue amicably and ensure that it doesn't escalate into a dispute.

The process of notification and consultation is often facilitated by the RBO and is also recognized under the treaties governing the following Basins: Orange-Seque, Mekong, Danube, and Rio- Colorado.

### Mekong River Basin

This principle came into play when Laos notified the Mekong River Commission (MRC) about its Xayaburi Hydropower Dam in 2010. Several studies were conducted by the MRC which led to redesigning of the Project in 2012. Thus the principle of notification and consultation ensured that Laos brought about changes in its actions keeping in mind the interests of all nations in the basin.



## Indus Water Treaty - Resolving Water Conflicts Through Arbitration

After the Partition of India and Pakistan in 1947, an understanding on the sharing of water of Indus River between the two countries became necessary to facilitate the development of water resources of this basin. After prolonged talks between the two Governments, the Indus Water Treaty was signed in September 1960. According to this Treaty, waters of the three western rivers (the Jhelum, the Chenab, and the Indus) were allocated to Pakistan, and those of the three eastern rivers (the Ravi, the Beas and the Sutlej) were allocated to India. Certain restrictions about water utilization were placed on India which is the upper riparian country.

The Indus Water Treaty is seen as a successful instance of conflict-resolution among countries in a constant state of tension. It has proved the effectiveness of involving a third party (World Bank) in negotiation. It has been working reasonably well despite the strained political relationship between India and Pakistan. Importantly, it continued to be honoured even during time of war. Undoubtedly differences do arise from time to time, but these usually get resolved within the framework of the Treaty. Minor differences are settled within the Commission, and major disputes go to the two Governments.

The two countries successfully resolved the Baglihar hydro-electric dam dispute (1999-2010) with issues concerning design parameters of the dam and water storage of the dam. A World Bank appointed neutral arbitrator, resolved the dispute by suggesting minor changes in the design of the dam and reducing the pondage from India's demand of 37.5 million m<sup>3</sup> to 32.5 million m<sup>3</sup>. India adhered to the changes.

In case of the Nimoo-Bazgo hydropower project, Pakistan first raised objections in 2002 over India securing Carbon Credits from the project without its mandate. After the talks of Foreign Secretaries of both countries, Pakistan in 2012 decided to drop its plans to file a lawsuit in the International Court of Arbitration. The project is scheduled to be completed by December 2013.

The Kishanganga hydroelectric project dispute is a high profile case, with Pakistan objecting that the project would lead to the diversion of Jhelum/Neelum waters. The dispute began in 2007 and is currently being addressed by the International Court of Arbitration (ICA) at The Hague and stands 'under arbitration'. In March 2013, the ICA gave a verdict on two fronts, where India has been allowed to divert the water to construct the project but has to maintain a minimum flow of water. The amount has to be determined by December 2013 based on the actual flow data submitted by both countries to the ICA.



## Negotiating Energy Price for Itaipu Dam

In 1973, Brazil and Paraguay signed a bilateral agreement to construct the Itaipu Dam, which is the largest hydroelectric project in the world. Paraguay complained about certain aspects of the 1973 Itaipu Treaty which requires it to sell its unused electricity only to Brazil and no other country at a fixed price until the treaty expires in 2023. In return, Brazil would pay Paraguay a lump sum in compensation, amounting to \$124 million a year in today's value. In 1985, Paraguay agreed to Brazil's request to sell Itaipu's electricity below market prices in order to help fight an economic crisis in Brazil.

Paraguay's President Fernando Lugo re-opened the case for negotiations on the fair energy price with Brazil in 2008. After hostility with previous governments, Brazil then agreed to negotiate and after months of discussions signed a 31-point document in 2009. The compromise includes Brazil paying Paraguay \$360 million a year for power from the dam, up from \$ 120 million. Another \$450 million dollars will fund a transmission line 350 kms long from the dam throughout Paraguay for widespread distribution of energy at lower costs. After 2023, both countries will be able to sell energy to third countries. By re-negotiating the disputed points of the original treaty, and incorporating Paraguay in its vision for the region, Brazil demonstrated a change in its political stance and a willingness to collaborate. Brazil subsequently also agreed to fund additional projects to help lift its neighbour from poverty and put it on a path of economic growth.

## Chapter 8 : Navigation

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This chapter aims to give an overview of the benefits derived from inland navigation, the measures required to be taken by countries to establish a navigation system, factors that hinder navigation and the impact of navigation on environment.

There are many benefits of inland navigation which include sea access to landlocked countries and economic development through trade and tourism. It also helps towards regional integration amongst co-riparians. Hence, discussions on water sharing and river basin management often include navigation.

Having a functional navigation programme requires legal instruments, the formation of a governing organization to regulate navigation, development of infrastructure as well as ensuring a navigable waterway. This is derived from an overall assessment of the navigation programs that are in existence in some basin and are underway in others.

Navigation however has an adverse impact on the environment and health of the river. Pollution from oil spills, biodiversity impact is commonly seen. This chapter gives a list of programmes developed in some basins to counteract such environmental impact of navigation. In this regard the efforts taken by the Rhine river basin stands out. It has one of the oldest navigation programmes in the world and it has taken several measures to balance the problems caused by navigation.



## 1. NAVIGATION PROGRAMMES

River Basin	In Treaty	In Operation
Senegal*	✓	Developing stage
Zambezi	✗	Developing stage
Orange-Senque	✗	Developing stage
Mekong	✓	✓
Amazon	✓	✓
La Plata	✓	Under negotiations
Danube	✗	✓
Rhine	✗	✓
Rio-Colorado	✓	✓
Great Lakes of North America	✓	✓
Yarmouk	✗	✗
Jordan**	✓	✗
Tigris-Euphrates	✗	✗
Orontes	✗	✗
El Kabir	✗	✗
Mountain Aquifer	—	—
Coastal Aquifer	—	—

\* Provision in the Senegal Water Charter 2002

\*\*As mentioned in the 1994 treaty

The treaties analysed above are the primary treaties under study. Some basins have separate agreements on navigation involving either all or some of the nations. One such example is the Revised Convention for Navigation on the Rhine (Mannheim Document) 17 October 1868 which established the Central Commission on the Navigation on Rhine (CCNR).

## 2. BENEFITS OF NAVIGATION

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1

### Sea Access to Landlocked Countries

#### Senegal River

Connecting Mali to the Atlantic Ocean

2

### Connecting Emerging Riparian Economies

#### Danube

Construction of multi-purpose Danube-Sava Canal shortening navigable route from 400 km to about 90 km

Development of the Danube-Bucharest Canal system by connecting Bucharest, the capital city of Romania with the Danube river through a waterway

Navigation on the river Tisza through an international waterway, and construction of a river port at the border junction of Ukraine, Slovakia and Hungary

Making the Sava river navigable as per the criteria of European inland waterways

Reconstruction and improvement of the Sava River in Croatia by integrating and modernizing of the Croatian infrastructure allowing for navigation, trade and transport of goods with other Western European countries

3

### Connecting Oceans Wide Apart

#### Rhine and Danube

##### Trans-European Transport Networks (TEN-T) Project by European Commission

East-West waterway connection on Rhine, Main, Meuse and Danube rivers through 3000 km of inland waterways, connecting the North Sea from the Netherlands to the Black Sea at the Danube Delta.



4

**Providing Access to Cargo Ships****La Plata****Tietê-Paraná River waterway**

Connects Brazil's largest city São Paulo to the Itaipú reservoir covering the distance of over 800 km

5

**Navigation Access Through shared River****Uruguay River waterway**

Access to navigation for Argentina, Uruguay and Brazil from downstream of Salto Grande dam shared by Uruguay and Argentina and upstream to São Borja in the Brazilian State of Rio Grande do Sul

6

**Perennial Navigation****Senegal****Integrated Multi-Modal Transport System (SITRAM) -- sub-regional transport system integrating all modes of surface**

Territorial connectivity between Senegal and Mauritania, 905 km between Ambidédi and St. Louis, construction of river port Ambidédi river-sea and port of Saint Louis, constructing access roads to existing and hydroelectric project Manantali, Diama of Koukoutamba and Boureya

7

**Free Cross-border Goods Transport****Mekong****Inland Water Transportation; Master Plan for Waterborne Transport on the Mekong River System in Cambodia**

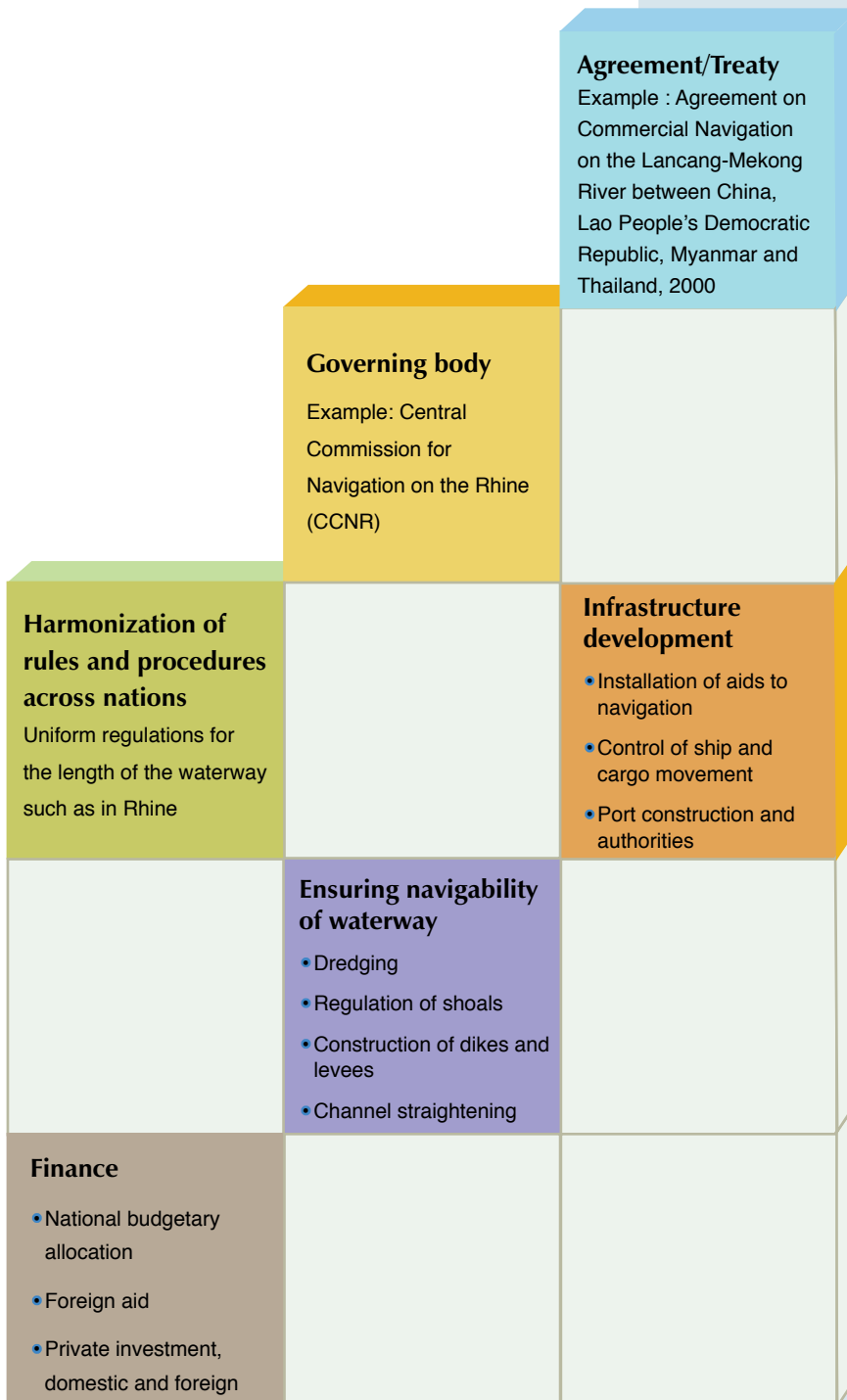
Agreement on Waterway Transportation between Cambodia and Vietnam allowing free cross border navigation for the transport of cargo and passengers through Mekong River, the Tonle Sap, Bassac and Vam Nao rivers and canals in Vietnam. As a result goods transported through the Phnom Penh Autonomous Port increased 45% in 2010

8

**Economic Development through Increase of Trade****Lower Mekong**

Volume of trade from inland navigation between Vietnam and Cambodia increased with annual cargo from Phnom Penh Port increasing from 278,000 tonnes to 430,000 tonnes between 2005-08.

### 3. BUILDING BLOCKS OF NAVIGATION SYSTEM



## 4. BARRIERS TO NAVIGATION

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**Siltation**



**Low Flow**



**Dams and Diversions**



**Seasonal Variations**



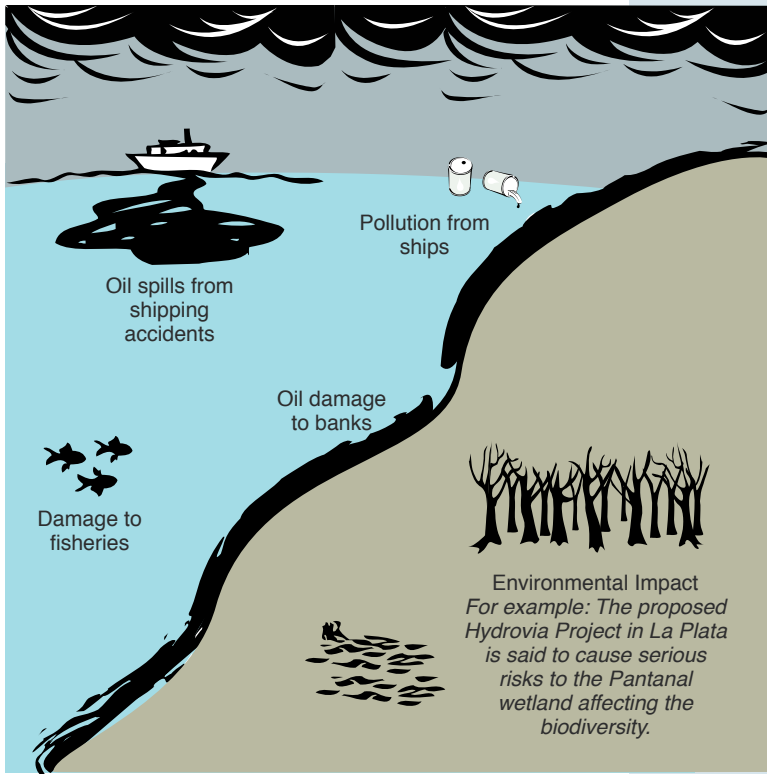
**Reefs**



**Rapids**



## 5. ADVERSE CONSEQUENCES



## 6. ENVIRONMENTAL PROTECTION PROJECTS

### Mekong

- A risk analysis and environmental impact assessment are underway to determine risks and impacts of increased navigation and port activities in Lao PDR and Thailand regarding storage, handling and carriage of dangerous goods.
- MRC has a Navigation Programme which:
  - Conducts regional surveys to improve traffic
  - Promotes cross border trade
  - Enhances waterway safety.

### Danube

A Joint Statement on Inland Navigation and Environmental Sustainability in the Danube River Basin (ICPDR, Danube Commission & International Commission for the Protection of the Sava River Basin).

### Rhine

**Central Commission on the Navigation on Rhine (CCNR) has developed regulations which are being implemented by states:**

- prevent any form of navigation that will cause pollution
- preventing pollution likely to be caused by the transport of dangerous goods
- prevent accidental pollution.

**CCNR has developed action plans to:**

- prevent inland navigation vessels emitting pollutants
- reduce emissions from vessel engines.

**The CCNR with the ICPR is developing the concept of ecological navigable waterways. This includes:**

- awareness of the possible impact of infrastructural work on the environment
- promotion of good practices in maintenance work on the waterway
- organization of workshops.

## ANNEXURE, SOURCES



## Annexure

### List of Treaties

(Some of the following treaties have led to the creation of river basin organizations selected for this study)

River Basin	Treaty/Treaties
Senegal	OMVS 1972-Convention creating the organization for the development of the Senegal River, August 11, 1972 Charter of the Senegal Water, 2002 Guinea became a party to the OMVS in 2006
Zambezi	Agreement on the Establishment of the Zambezi Watercourse Commission, 2004
Orange-Senque	Agreement between the Governments of the Republic of Botswana, Kingdom of Lesotho, Republic of Namibia and Republic of South Africa on the Establishment of the Orange-Senque Commission, 3 November, 2000
Mekong	Agreement on the Cooperation for the Sustainable Development of the Mekong River Basin, 5 April, 1995.
Amazon	Treaty for Amazonian Cooperation, 3 July, 1978
La Plata	Estatuto Del Comité Intergubernamental Coordinador De Los Países De La Cuenca Del Plata, 1968 (Text in Spanish) Treaty of the River Plata Basin, 1969
Danube	Convention on cooperation for the protection and sustainable use of the Danube River was signed in 1996 and came into force in 1998
Rhine	Convention on the Protection of Rhine, 1999

Rio-Colorado	Treaty between the United States of America and Mexico relating to the utilization of the waters of Colorado and Tijuana Rivers and of the Rio Grande, 1944
Great Lakes of North America	Treaty between the United States and Great Britain Relating to Boundary Waters and Questions Arising Between the United States and Canada, 1909 Great Lakes of North America Water Quality Agreement, 1978
Yarmouk	Agreement concerning the utilization of the Yarmouk waters between the Syria Arab Republic and Jordan, 1987
Jordan	Treaty of Peace between the Hashemite Kingdom of Jordan and the State of Israel, 1994
Tigris-Euphrates	Treaty between Turkey and Iran on the Sarisu and Karasu River, 1955 (text not available) Protocol on matters pertaining to economic cooperation, 1987 (Syria and Turkey) Agreement between Syria and Iraq concerning the installation of a Syrian pump station on the Tigris River for irrigation purposes, 2002 (text not available)
Shatt al' Arab	Treaty Concerning the State Frontier and Neighbourly Relations between Iran and Iraq and its protocol, 1975
Orontes	Agreement between the Syrian Arab Republic and the Lebanese Republic on the distribution of water of Al-Asi River rising in Lebanon, 1994 (English translation not available)
El Kabir	An agreement between the Syrian Arab Republic and the Lebanese Republic for the sharing of the Great Southern River basin and building of a joint dam on the main course of the river, 2002.
Mountain Aquifer and Coastal Aquifer	The Israeli-Palestinian interim agreement on the West Bank and the Gaza Strip. Oslo II - Protocol Concerning Civil Affairs (Annex III), 28 September, 1995

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**Most of the countries in the Middle East are at risk of war because they have avoided regional cooperation in water.** If they want to construct a river basin organisation or enter into another form of regional water cooperation arrangement, all the elements from experiences around the world are available.

This report provides evidence of a problem that has been neglected for too long. It also provides detailed options for solutions. A must for political leaders and researchers alike, this report is an essential tool for everyone in the Middle East and elsewhere to build peace and cooperation.

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