Water Risk Filter

Country Overview - Syria

Water Indicators

Indicator	Value	Description	Source
Overall Basin Risk (score)	3.17	Overall Basin Risk (score)	
Overall Basin Risk (rank)	14	Overall Basin Risk (rank)	
Physical risk (score)	3.42	Physical risk (score)	
Physical risk (rank)	6	Physical risk (rank)	
Regulatory risk (score)	3.25	Regulatory risk (score)	
Regulatory risk (rank)	40	Regulatory risk (rank)	
Reputation risk (score)	2.32	Reputation risk (score)	
Reputation risk (rank)	154	Reputation risk (rank)	
1. Quantity - Scarcity (score)	3.84	1. Quantity - Scarcity (score)	
1. Quantity - Scarcity (rank)	16	1. Quantity - Scarcity (rank)	
2. Quantity - Flooding (score)	2.31	2. Quantity - Flooding (score)	
2. Quantity - Flooding (rank)	148	2. Quantity - Flooding (rank)	
3. Quality (score)	4.19	3. Quality (score)	
3. Quality (rank)	9	3. Quality (rank)	
4. Ecosystem Service Status (score)	2.60	4. Ecosystem Service Status (score)	
4. Ecosystem Service Status (rank)	78	4. Ecosystem Service Status (rank)	
5. Enabling Environment (Policy & Laws) (score)	3.00	5. Enabling Environment (Policy & Laws) (score)	
5. Enabling Environment (Policy & Laws) (rank)	61	5. Enabling Environment (Policy & Laws) (rank)	
6. Institutions and Governance (score)	4.50	6. Institutions and Governance (score)	
6. Institutions and Governance (rank)	6	6. Institutions and Governance (rank)	
7. Management Instruments (score)	3.00	7. Management Instruments (score)	
7. Management Instruments (rank)	80	7. Management Instruments (rank)	
8 - Infrastructure & Finance (score)	1.65	8 - Infrastructure & Finance (score)	
8 - Infrastructure & Finance (rank)	116	8 - Infrastructure & Finance (rank)	
9. Cultural Diversity (score)	3.00	9. Cultural importance (score)	
9. Cultural Diversity (rank)	32	9. Cultural importance (rank)	
10. Biodiversity Importance (score)	3.06	10. Biodiversity importance (score)	

Water Risk Filter

Country Overview - Syria

Indicator	Value	Description	Source
10. Biodiversity Importance (rank)	118	10. Biodiversity importance (rank)	
11. Media Scrutiny (score)	2.00	11. Media Scrutiny (score)	
11. Media Scrutiny (rank)	187	11. Media Scrutiny (rank)	
12. Conflict (score)	2.16	12. Conflict (score)	
12. Conflict (rank)	132	12. Conflict (rank)	
1.0 - Aridity (score)	3.29	The aridity risk indicator is based on the Global Aridity Index (Global-Aridity) and Global Potential Evapo-Transpiration (Global-PET) Geospatial data sets by Trabucco and Zomer (2009). These data sets provide information about the potential availability of water in regions with low water demand, thus they are used in the Water Risk Filter 5.0 to better account for deserts and other arid areas in the risk assessment.	Trabucco, A., & Zomer, R. J. (2009). Global potential evapo-transpiration (Global-PET) and global aridity index (Global-Aridity) geo-database. CGIAR consortium for spatial information.
1.0 - Aridity (rank)	30	The aridity risk indicator is based on the Global Aridity Index (Global-Aridity) and Global Potential Evapo-Transpiration (Global-PET) Geospatial data sets by Trabucco and Zomer (2009). These data sets provide information about the potential availability of water in regions with low water demand, thus they are used in the Water Risk Filter 5.0 to better account for deserts and other arid areas in the risk assessment.	Trabucco, A., & Zomer, R. J. (2009). Global potential evapo-transpiration (Global-PET) and global aridity index (Global-Aridity) geo-database. CGIAR consortium for spatial information.
1.1 - Water Depletion (score)	2.88	The water depletion risk indicator is based on annual average monthly net water depletion from Brauman et al. (2016). Their analysis is based on model outputs from the newest version of the integrated water resources model WaterGAP3 which measures water depletion as the ratio of water consumption-to-availability.	Brauman, K. A., Richter, B. D., Postel, S., Malsy, M., & Flörke, M. (2016). Water depletion: An improved metric for incorporating seasonal and dry-year water scarcity into water risk assessments. Elem Sci Anth, 4.
1.1 - Water Depletion (rank)	62	The water depletion risk indicator is based on annual average monthly net water depletion from Brauman et al. (2016). Their analysis is based on model outputs from the newest version of the integrated water resources model WaterGAP3 which measures water depletion as the ratio of water consumption-to-availability.	Brauman, K. A., Richter, B. D., Postel, S., Malsy, M., & Flörke, M. (2016). Water depletion: An improved metric for incorporating seasonal and dry-year water scarcity into water risk assessments. Elem Sci Anth, 4.
1.2 - Baseline Water Stress (score)	3.40	World Resources Institute’s Baseline Water Stress measures the ratio of total annual water withdrawals to total available annual renewable supply, accounting for upstream consumptive use. A higher percentage indicates more competition among users.	Hofste, R., Kuzma, S., Walker, S., ... & Sutanudjaja, E.H. (2019). Aqueduct 3.0: Updated decision relevant global water risk indicators. Technical note. Washington, DC: World Resources Institute.

Indicator	Value	Description	Source
1.2 - Baseline Water Stress (rank)	43	World Resources Institute’s Baseline Water Stress measures the ratio of total annual water withdrawals to total available annual renewable supply, accounting for upstream consumptive use. A higher percentage indicates more competition among users.	Hofste, R., Kuzma, S., Walker, S., ... & Sutanudjaja, E.H. (2019). Aqueduct 3.0: Updated decision relevant global water risk indicators. Technical note. Washington, DC: World Resources Institute.
1.3 - Blue Water Scarcity (score)	4.47	The blue water scarcity risk indicator is based on Mekonnen and Hoekstra (2016) global assessment of blue water scarcity on a monthly basis and at high spatial resolution (grid cells of 30 × 30 arc min resolution). Blue water scarcity is calculated as the ratio of the blue water footprint in a grid cell to the total blue water availability in the cell. The time period analyzed in this study ranges from 1996 to 2005.	Mekonnen, M. M., & Hoekstra, A. Y. (2016). Four billion people facing severe water scarcity. Science advances, 2(2), e1500323.
1.3 - Blue Water Scarcity (rank)	29	The blue water scarcity risk indicator is based on Mekonnen and Hoekstra (2016) global assessment of blue water scarcity on a monthly basis and at high spatial resolution (grid cells of 30 × 30 arc min resolution). Blue water scarcity is calculated as the ratio of the blue water footprint in a grid cell to the total blue water availability in the cell. The time period analyzed in this study ranges from 1996 to 2005.	Mekonnen, M. M., & Hoekstra, A. Y. (2016). Four billion people facing severe water scarcity. Science advances, 2(2), e1500323.
1.4 - Projected Change in Water Discharge (by ~2050) (score)	3.74	This risk indicator is based on multi-model simulation that applies both global climate and hydrological models from the Inter-Sectoral Impact Model Intercomparison Project (ISIMIP). To estimate the change at 2°C of global warming above 1980-2010 levels, simulated annual water discharge was averaged over a 31-year period with 2°C mean warming. Results are expressed in terms of relative change (%) in probability between present day (1980-2010) conditions and 2°C scenarios by 2050.	Schewe, J., Heinke, J., Gerten, D., Haddeland, I., Arnell, N. W., Clark, D. B., ... & Gosling, S. N. (2014). Multimodel assessment of water scarcity under climate change. Proceedings of the National Academy of Sciences, 111(9), 3245-3250.
1.4 - Projected Change in Water Discharge (by ~2050) (rank)	4	This risk indicator is based on multi-model simulation that applies both global climate and hydrological models from the Inter-Sectoral Impact Model Intercomparison Project (ISIMIP). To estimate the change at 2°C of global warming above 1980-2010 levels, simulated annual water discharge was averaged over a 31-year period with 2°C mean warming. Results are expressed in terms of relative change (%) in probability between present day (1980-2010) conditions and 2°C scenarios by 2050.	Schewe, J., Heinke, J., Gerten, D., Haddeland, I., Arnell, N. W., Clark, D. B., ... & Gosling, S. N. (2014). Multimodel assessment of water scarcity under climate change. Proceedings of the National Academy of Sciences, 111(9), 3245-3250.

Indicator	Value	Description	Source
1.5 - Drought Frequency Probability (score)	4.75	This risk indicator is based on the Standardized Precipitation and Evaporation Index (SPEI). Vicente-Serrano et al. (2010) developed this multi-scalar drought index applying both precipitation and temperature data to detect, monitor and analyze different drought types and impacts in the context of global warming. The mathematical calculations used for SPEI are similar to the Standard Precipitation Index (SPI), but it has the advantage to include the role of evapotranspiration.	Vicente-Serrano, S. M., Beguería, S., & López-Moreno, J. I. (2010). A multiscalar drought index sensitive to global warming: the standardized precipitation evapotranspiration index. Journal of climate, 23(7), 1696-1718.
1.5 - Drought Frequency Probability (rank)	17	This risk indicator is based on the Standardized Precipitation and Evaporation Index (SPEI). Vicente-Serrano et al. (2010) developed this multi-scalar drought index applying both precipitation and temperature data to detect, monitor and analyze different drought types and impacts in the context of global warming. The mathematical calculations used for SPEI are similar to the Standard Precipitation Index (SPI), but it has the advantage to include the role of evapotranspiration.	Vicente-Serrano, S. M., Beguería, S., & López-Moreno, J. I. (2010). A multiscalar drought index sensitive to global warming: the standardized precipitation evapotranspiration index. Journal of climate, 23(7), 1696-1718.
1.6 - Projected Change in Drought Occurrence (by ~2050) (score)	4.54	This risk indicator is based on multi-model simulation that applies both global climate and drought models from the Inter-Sectoral Impact Model Intercomparison Project (ISIMIP) . A drought threshold for pre-industrial conditions was calculated based on time-series averages. Results are expressed in terms of relative change (%) in probability between pre-industrial and 2°C scenarios.	Frieler, K., Lange, S., Piontek, F., Reyer, C. P., Schewe, J., Warszawski, L., ... & Geiger, T. (2017). Assessing the impacts of 1.5 C global warming–simulation protocol of the Inter-Sectoral Impact Model Intercomparison Project (ISIMIP2b). Geoscientific Model Development.
1.6 - Projected Change in Drought Occurrence (by ~2050) (rank)	9	This risk indicator is based on multi-model simulation that applies both global climate and drought models from the Inter-Sectoral Impact Model Intercomparison Project (ISIMIP) . A drought threshold for pre-industrial conditions was calculated based on time-series averages. Results are expressed in terms of relative change (%) in probability between pre-industrial and 2°C scenarios.	Frieler, K., Lange, S., Piontek, F., Reyer, C. P., Schewe, J., Warszawski, L., ... & Geiger, T. (2017). Assessing the impacts of 1.5 C global warming–simulation protocol of the Inter-Sectoral Impact Model Intercomparison Project (ISIMIP2b). Geoscientific Model Development.
2.1 - Estimated Flood Occurrence (score)	2.38	This risk indicator is based on the recurrence of floods within the 34-year time frame period of 1985 to 2019. The occurrence of floods within a given location was estimated using data from Flood Observatory, University of Colorado. The Flood Observatory use data derived from a wide variety of news, governmental, instrumental, and remote sensing source.	Brakenridge, G. R. (2019). Global active archive of large flood events. Dartmouth Flood Observatory, University of Colorado.
2.1 - Estimated Flood Occurrence (rank)	144	This risk indicator is based on the recurrence of floods within the 34-year time frame period of 1985 to 2019. The occurrence of floods within a given location was estimated using data from Flood Observatory, University of Colorado. The Flood Observatory use data derived from a wide variety of news, governmental, instrumental, and remote sensing source.	Brakenridge, G. R. (2019). Global active archive of large flood events. Dartmouth Flood Observatory, University of Colorado.

Indicator	Value	Description	Source
2.2 - Projected Change in Flood Occurrence (by ~2050) (score)	1.00	This risk indicator is based on multi-model simulation that applies both global climate and drought models from the Inter-Sectoral Impact Model Intercomparison Project (ISIMIP). The magnitude of the flood event was defined based on 100-year return period for pre-industrial conditions. Results are expressed in terms of change (%) in probability between pre-industrial and 2°C scenarios.	Frieler, K., Lange, S., Piontek, F., Reyer, C. P., Schewe, J., Warszawski, L., ... & Geiger, T. (2017). Assessing the impacts of 1.5 C global warming–simulation protocol of the Inter-Sectoral Impact Model Intercomparison Project (ISIMIP2b). Geoscientific Model Development.
2.2 - Projected Change in Flood Occurrence (by ~2050) (rank)	189	This risk indicator is based on multi-model simulation that applies both global climate and drought models from the Inter-Sectoral Impact Model Intercomparison Project (ISIMIP). The magnitude of the flood event was defined based on 100-year return period for pre-industrial conditions. Results are expressed in terms of change (%) in probability between pre-industrial and 2°C scenarios.	Frieler, K., Lange, S., Piontek, F., Reyer, C. P., Schewe, J., Warszawski, L., ... & Geiger, T. (2017). Assessing the impacts of 1.5 C global warming–simulation protocol of the Inter-Sectoral Impact Model Intercomparison Project (ISIMIP2b). Geoscientific Model Development.
3.1 - Surface Water Contamination Index (score)	4.19	The underlying data for this risk indicator is based on a broad suite of pollutants with well-documented direct or indirect negative effects on water security for both humans and freshwater biodiversity, compiled by Vörösmarty et al. (2010). The negative effects are specific to individual pollutants, ranging from impacts mediated by eutrophication such as algal blooms and oxygen depletion (e.g., caused by phosphorus and organic loading) to direct toxic effects (e.g., caused by pesticides, mercury). The overall Surface Water Contamination Index is calculated based on a range of key pollutants with different weightings according to the level of their negative effects on water security for both humans and freshwater biodiversity: soil salinization (8%), nitrogen (12%) and phosphorus (P, 13%) loading, mercury deposition (5%), pesticide loading (10%), sediment loading (17%), organic loading (as Biological Oxygen Demand, BOD; 15%), potential acidification (9%), and thermal alteration (11%).	Vörösmarty, C. J., McIntyre, P. B., Gessner, M. O., Dudgeon, D., Prusevich, A., Green, P., ... & Davies, P. M. (2010). Global threats to human water security and river biodiversity. Nature, 467(7315), 555.

Indicator	Value	Description	Source
3.1 - Surface Water Contamination Index (rank)	9	The underlying data for this risk indicator is based on a broad suite of pollutants with well-documented direct or indirect negative effects on water security for both humans and freshwater biodiversity, compiled by Vörösmarty et al. (2010). The negative effects are specific to individual pollutants, ranging from impacts mediated by eutrophication such as algal blooms and oxygen depletion (e.g., caused by phosphorus and organic loading) to direct toxic effects (e.g., caused by pesticides, mercury). The overall Surface Water Contamination Index is calculated based on a range of key pollutants with different weightings according to the level of their negative effects on water security for both humans and freshwater biodiversity: soil salinization (8%), nitrogen (12%) and phosphorus (P, 13%) loading, mercury deposition (5%), pesticide loading (10%), sediment loading (17%), organic loading (as Biological Oxygen Demand, BOD; 15%), potential acidification (9%), and thermal alteration (11%).	Vörösmarty, C. J., McIntyre, P. B., Gessner, M. O., Dudgeon, D., Prusevich, A., Green, P., ... & Davies, P. M. (2010). Global threats to human water security and river biodiversity. Nature, 467(7315), 555.
4.1 - Fragmentation Status of Rivers (score)	3.00	This risk indicator is based on the data set by Grill et al. (2019) mapping the world’s free-flowing rivers. Grill et al. (2019) compiled a geometric network of the global river system and associated attributes, such as hydro-geometric properties, as well as pressure indicators to calculate an integrated connectivity status index (CSI). While only rivers with high levels of connectivity in their entire length are classified as free-flowing, rivers of CSI < 95% are considered as fragmented at a certain degree.	Grill, G., Lehner, B., Thieme, M., Geenen, B., Tickner, D., Antonelli, F., ... & Macedo, H. E. (2019). Mapping the world’s free-flowing rivers. Nature, 569(7755), 215.
4.1 - Fragmentation Status of Rivers (rank)	60	This risk indicator is based on the data set by Grill et al. (2019) mapping the world’s free-flowing rivers. Grill et al. (2019) compiled a geometric network of the global river system and associated attributes, such as hydro-geometric properties, as well as pressure indicators to calculate an integrated connectivity status index (CSI). While only rivers with high levels of connectivity in their entire length are classified as free-flowing, rivers of CSI < 95% are considered as fragmented at a certain degree.	Grill, G., Lehner, B., Thieme, M., Geenen, B., Tickner, D., Antonelli, F., ... & Macedo, H. E. (2019). Mapping the world’s free-flowing rivers. Nature, 569(7755), 215.
4.2 - Catchment Ecosystem Services Degradation Level (tree cover loss) (score)	1.06	For this risk indicator, tree cover loss was applied as a proxy to represent catchment ecosystem services degradation since forests play an important role in terms of water regulation, supply and pollution control. The forest cover data is based on Hansen et al.’s global Landsat data at a 30-meter spatial resolution to characterize forest cover and change. The authors defined trees as vegetation taller than 5 meters in height, and forest cover loss as a stand-replacement disturbance, or a change from a forest to non-forest state, during the period 2000 – 2018.	Hansen, M. C., Potapov, P. V., Moore, R., Hancher, M., Turubanova, S. A. A., Tyukavina, A., ... & Kommareddy, A. (2013). High-resolution global maps of 21st-century forest cover change. science, 342(6160), 850-853.

Indicator	Value	Description	Source
4.2 - Catchment Ecosystem Services Degradation Level (tree cover loss) (rank)	142	For this risk indicator, tree cover loss was applied as a proxy to represent catchment ecosystem services degradation since forests play an important role in terms of water regulation, supply and pollution control. The forest cover data is based on Hansen et al.'s global Landsat data at a 30-meter spatial resolution to characterize forest cover and change. The authors defined trees as vegetation taller than 5 meters in height, and forest cover loss as a stand-replacement disturbance, or a change from a forest to non-forest state, during the period 2000 – 2018.	Hansen, M. C., Potapov, P. V., Moore, R., Hancher, M., Turubanova, S. A. A., Tyukavina, A., ... & Kommareddy, A. (2013). High-resolution global maps of 21st-century forest cover change. science, 342(6160), 850-853.
4.3 - Projected Impacts on Freshwater Biodiversity (score)	4.69	The study by Tedesco et al. (2013) to project changes [% increase or decrease] in extinction rate by ~2090 of freshwater fish due to water availability loss from climate change is used as a proxy to estimate the projected impacts on freshwater biodiversity.	Tedesco, P. A., Oberdorff, T., Cornu, J. F., Beauchard, O., Brosse, S., Dürr, H. H., ... & Hugueny, B. (2013). A scenario for impacts of water availability loss due to climate change on riverine fish extinction rates. Journal of Applied Ecology, 50(5), 1105-1115.
4.3 - Projected Impacts on Freshwater Biodiversity (rank)	10	The study by Tedesco et al. (2013) to project changes [% increase or decrease] in extinction rate by ~2090 of freshwater fish due to water availability loss from climate change is used as a proxy to estimate the projected impacts on freshwater biodiversity.	Tedesco, P. A., Oberdorff, T., Cornu, J. F., Beauchard, O., Brosse, S., Dürr, H. H., ... & Hugueny, B. (2013). A scenario for impacts of water availability loss due to climate change on riverine fish extinction rates. Journal of Applied Ecology, 50(5), 1105-1115.
5.1 - Freshwater Policy Status (SDG 6.5.1) (score)	3.00	This risk indicator is based on SDG 6.5.1. Degree of IWRM Implementation "National Water Resources Policy" indicator, which corresponds to one of the three national level indicators under the Enabling Environment category.	UN Environment (2018). Progress on integrated water resources management. Global baseline for SDG 6 Indicator 6.5.1: degree of IWRM implementation.
5.1 - Freshwater Policy Status (SDG 6.5.1) (rank)	41	This risk indicator is based on SDG 6.5.1. Degree of IWRM Implementation "National Water Resources Policy" indicator, which corresponds to one of the three national level indicators under the Enabling Environment category.	UN Environment (2018). Progress on integrated water resources management. Global baseline for SDG 6 Indicator 6.5.1: degree of IWRM implementation.
5.2 - Freshwater Law Status (SDG 6.5.1) (score)	3.00	This risk indicator is based on SDG 6.5.1. Degree of IWRM Implementation "National Water Resources Law(s)" indicator, which corresponds to one of the three national level indicators under the Enabling Environment category. For SDG 6.5.1, enabling environment depicts the conditions that help to support the implementation of IWRM, which includes legal and strategic planning tools for IWRM.	UN Environment (2018). Progress on integrated water resources management. Global baseline for SDG 6 Indicator 6.5.1: degree of IWRM implementation.

Indicator	Value	Description	Source
5.2 - Freshwater Law Status (SDG 6.5.1) (rank)	48	This risk indicator is based on SDG 6.5.1. Degree of IWRM Implementation "National Water Resources Law(s)" indicator, which corresponds to one of the three national level indicators under the Enabling Environment category. For SDG 6.5.1, enabling environment depicts the conditions that help to support the implementation of IWRM, which includes legal and strategic planning tools for IWRM.	UN Environment (2018). Progress on integrated water resources management. Global baseline for SDG 6 Indicator 6.5.1: degree of IWRM implementation.
5.3 - Implementation Status of Water Management Plans (SDG 6.5.1) (score)	3.00	This risk indicator is based on SDG 6.5.1. Degree of IWRM Implementation "National IWRM plans" indicator, which corresponds to one of the three national level indicators under the Enabling Environment category. For SDG 6.5.1, enabling environment depicts the conditions that help to support the implementation of IWRM, which includes legal and strategic planning tools for IWRM.	UN Environment (2018). Progress on integrated water resources management. Global baseline for SDG 6 Indicator 6.5.1: degree of IWRM implementation.
5.3 - Implementation Status of Water Management Plans (SDG 6.5.1) (rank)	52	This risk indicator is based on SDG 6.5.1. Degree of IWRM Implementation "National IWRM plans" indicator, which corresponds to one of the three national level indicators under the Enabling Environment category. For SDG 6.5.1, enabling environment depicts the conditions that help to support the implementation of IWRM, which includes legal and strategic planning tools for IWRM.	UN Environment (2018). Progress on integrated water resources management. Global baseline for SDG 6 Indicator 6.5.1: degree of IWRM implementation.
6.1 - Corruption Perceptions Index (score)	5.00	This risk Indicator is based on the latest Transparency International's data: the Corruption Perceptions Index 2018. This index aggregates data from a number of different sources that provide perceptions of business people and country experts on the level of corruption in the public sector.	Transparency International (2019). Corruption Perceptions Index 2018. Berlin: Transparency International.
6.1 - Corruption Perceptions Index (rank)	5	This risk Indicator is based on the latest Transparency International's data: the Corruption Perceptions Index 2018. This index aggregates data from a number of different sources that provide perceptions of business people and country experts on the level of corruption in the public sector.	Transparency International (2019). Corruption Perceptions Index 2018. Berlin: Transparency International.
6.2 - Freedom in the World Index (score)	5.00	This risk indicator is based on Freedom House (2019), an annual global report on political rights and civil liberties, composed of numerical ratings and descriptive texts for each country and a select group of territories. The 2019 edition involved more than 100 analysts and more than 30 advisers with global, regional, and issue-based expertise to covers developments in 195 countries and 14 territories from January 1, 2018, through December 31, 2018.	Freedom House (2019). Freedom in the world 2019. Washington, DC: Freedom House.

Indicator	Value	Description	Source
6.2 - Freedom in the World Index (rank)	7	This risk indicator is based on Freedom House (2019), an annual global report on political rights and civil liberties, composed of numerical ratings and descriptive texts for each country and a select group of territories. The 2019 edition involved more than 100 analysts and more than 30 advisers with global, regional, and issue-based expertise to covers developments in 195 countries and 14 territories from January 1, 2018, through December 31, 2018.	Freedom House (2019). Freedom in the world 2019. Washington, DC: Freedom House.
6.3 - Business Participation in Water Management (SDG 6.5.1) (score)	3.00	This risk indicator is based on SDG 6.5.1. Degree of IWRM Implementation “Business Participation in Water Resources Development, Management and Use” indicator, which corresponds to one of the six national level indicators under the Institutions and Participation category.	UN Environment (2018). Progress on integrated water resources management. Global baseline for SDG 6 Indicator 6.5.1: degree of IWRM implementation.
6.3 - Business Participation in Water Management (SDG 6.5.1) (rank)	49	This risk indicator is based on SDG 6.5.1. Degree of IWRM Implementation “Business Participation in Water Resources Development, Management and Use” indicator, which corresponds to one of the six national level indicators under the Institutions and Participation category.	UN Environment (2018). Progress on integrated water resources management. Global baseline for SDG 6 Indicator 6.5.1: degree of IWRM implementation.
7.1 - Management Instruments for Water Management (SDG 6.5.1) (score)	3.00	This risk indicator is based on SDG 6.5.1. Degree of IWRM Implementation “Sustainable and efficient water use management” indicator, which corresponds to one of the five national level indicators under the Management Instruments category. For SDG 6.5.1, management instruments refer to the tools and activities that enable decision-makers and users to make rational and informed choices between alternative actions.	UN Environment (2018). Progress on integrated water resources management. Global baseline for SDG 6 Indicator 6.5.1: degree of IWRM implementation.
7.1 - Management Instruments for Water Management (SDG 6.5.1) (rank)	31	This risk indicator is based on SDG 6.5.1. Degree of IWRM Implementation “Sustainable and efficient water use management” indicator, which corresponds to one of the five national level indicators under the Management Instruments category. For SDG 6.5.1, management instruments refer to the tools and activities that enable decision-makers and users to make rational and informed choices between alternative actions.	UN Environment (2018). Progress on integrated water resources management. Global baseline for SDG 6 Indicator 6.5.1: degree of IWRM implementation.

Indicator	Value	Description	Source
7.2 - Groundwater Monitoring Data Availability and Management (score)	3.00	This risk indicator is based on the data set by UN IGRAC (2019) to determine the level of availability of groundwater monitoring data at country level as groundwater management decisions rely strongly on data availability. The level of groundwater monitoring data availability for groundwater management is determined according to a combination of three criteria developed by WWF and IGRAC: 1) Status of country groundwater monitoring programme, 2) groundwater data availability for NGOs and 3) Public access to processed groundwater monitoring data.	UN IGRAC (2019). Global Groundwater Monitoring Network GGMN Portal. UN International Groundwater Resources Assessment Centre (IGRAC).
7.2 - Groundwater Monitoring Data Availability and Management (rank)	33	This risk indicator is based on the data set by UN IGRAC (2019) to determine the level of availability of groundwater monitoring data at country level as groundwater management decisions rely strongly on data availability. The level of groundwater monitoring data availability for groundwater management is determined according to a combination of three criteria developed by WWF and IGRAC: 1) Status of country groundwater monitoring programme, 2) groundwater data availability for NGOs and 3) Public access to processed groundwater monitoring data.	UN IGRAC (2019). Global Groundwater Monitoring Network GGMN Portal. UN International Groundwater Resources Assessment Centre (IGRAC).
7.3 - Density of Runoff Monitoring Stations (score)	3.03	The density of monitoring stations for water quantity was applied as proxy to develop this risk indicator. The Global Runoff Data Base was used to estimate the number of monitoring stations per 1000km2 of the main river system (data base access date: May 2018).	BfG (2019). Global Runoff Data Base. German Federal Institute of Hydrology (BfG).
7.3 - Density of Runoff Monitoring Stations (rank)	115	The density of monitoring stations for water quantity was applied as proxy to develop this risk indicator. The Global Runoff Data Base was used to estimate the number of monitoring stations per 1000km2 of the main river system (data base access date: May 2018).	BfG (2019). Global Runoff Data Base. German Federal Institute of Hydrology (BfG).
8.1 - Access to Safe Drinking Water (score)	1.00	This risk indicator is based on the Joint Monitoring Programme for Water Supply, Sanitation and Hygiene (UNICEF/WHO) 2019 data. It provides estimates on the use of water, sanitation and hygiene by country for the period 2000-2017.	WHO & UNICEF (2019). Estimates on the use of water, sanitation and hygiene by country (2000-2017). Joint Monitoring Programme for Water Supply, Sanitation and Hygiene.
8.1 - Access to Safe Drinking Water (rank)	95	This risk indicator is based on the Joint Monitoring Programme for Water Supply, Sanitation and Hygiene (UNICEF/WHO) 2019 data. It provides estimates on the use of water, sanitation and hygiene by country for the period 2000-2017.	WHO & UNICEF (2019). Estimates on the use of water, sanitation and hygiene by country (2000-2017). Joint Monitoring Programme for Water Supply, Sanitation and Hygiene.
8.2 - Access to Sanitation (score)	2.00	This risk indicator is based on the Joint Monitoring Programme for Water Supply, Sanitation and Hygiene (UNICEF/WHO) 2019 data. It provides estimates on the use of water, sanitation and hygiene by country for the period 2000-2017.	WHO & UNICEF (2019). Estimates on the use of water, sanitation and hygiene by country (2000-2017). Joint Monitoring Programme for Water Supply, Sanitation and Hygiene.

Indicator	Value	Description	Source
8.2 - Access to Sanitation (rank)	101	This risk indicator is based on the Joint Monitoring Programme for Water Supply, Sanitation and Hygiene (UNICEF/WHO) 2019 data. It provides estimates on the use of water, sanitation and hygiene by country for the period 2000-2017.	WHO & UNICEF (2019). Estimates on the use of water, sanitation and hygiene by country (2000-2017). Joint Monitoring Programme for Water Supply, Sanitation and Hygiene.
8.3 - Financing for Water Resource Development and Management (SDG 6.5.1) (score)	3.00	This risk indicator is based on the average 'Financing' score of UN SDG 6.5.1. Degree of IWRM Implementation database. UN SDG 6.5.1 database contains a category on financing which assesses different aspects related to budgeting and financing made available and used for water resources development and management from various sources.	UN Environment (2018). Progress on integrated water resources management. Global baseline for SDG 6 Indicator 6.5.1: degree of IWRM implementation.
8.3 - Financing for Water Resource Development and Management (SDG 6.5.1) (rank)	69	This risk indicator is based on the average 'Financing' score of UN SDG 6.5.1. Degree of IWRM Implementation database. UN SDG 6.5.1 database contains a category on financing which assesses different aspects related to budgeting and financing made available and used for water resources development and management from various sources.	UN Environment (2018). Progress on integrated water resources management. Global baseline for SDG 6 Indicator 6.5.1: degree of IWRM implementation.
9.1 - Cultural Diversity (score)	3.00	Water is a social and cultural good. The cultural diversity risk indicator was included in order to acknowledge that businesses face reputational risk due to the importance of freshwater for indigenous and traditional people in their daily life, religion and culture. This risk indicator is based on Oviedo and Larsen (2000) data set, which mapped the world's ethnolinguistic groups onto the WWF map of the world's ecoregions. This cross-mapping showed for the very first time the significant overlap that exists between the global geographic distribution of biodiversity and that of linguistic diversity.	Oviedo, G., Maffi, L., & Larsen, P. B. (2000). Indigenous and traditional peoples of the world and ecoregion conservation: An integrated approach to conserving the world's biological and cultural diversity. Gland: WWF (World Wide Fund for Nature) International.
9.1 - Cultural Diversity (rank)	32	Water is a social and cultural good. The cultural diversity risk indicator was included in order to acknowledge that businesses face reputational risk due to the importance of freshwater for indigenous and traditional people in their daily life, religion and culture. This risk indicator is based on Oviedo and Larsen (2000) data set, which mapped the world's ethnolinguistic groups onto the WWF map of the world's ecoregions. This cross-mapping showed for the very first time the significant overlap that exists between the global geographic distribution of biodiversity and that of linguistic diversity.	Oviedo, G., Maffi, L., & Larsen, P. B. (2000). Indigenous and traditional peoples of the world and ecoregion conservation: An integrated approach to conserving the world's biological and cultural diversity. Gland: WWF (World Wide Fund for Nature) International.
10.1 - Freshwater Endemism (score)	4.09	The underlying data set for this risk indicator comes from the Freshwater Ecoregions of the World (FEOW) 2015 data developed by WWF and TNC. Companies operating in basins with higher number of endemic fish species are exposed to higher reputational risks.	WWF & TNC (2015). Freshwater Ecoregions of the World.

Indicator	Value	Description	Source
10.1 - Freshwater Endemism (rank)	69	The underlying data set for this risk indicator comes from the Freshwater Ecoregions of the World (FEOW) 2015 data developed by WWF and TNC. Companies operating in basins with higher number of endemic fish species are exposed to higher reputational risks.	WWF & TNC (2015). Freshwater Ecoregions of the World.
10.2 - Freshwater Biodiversity Richness (score)	2.02	The underlying data set for this risk indicator comes from the Freshwater Ecoregions of the World (FEOW) 2015 data developed by WWF and TNC. Count of fish species is used as a representation of freshwater biodiversity richness. Companies operating in basins with higher number of fish species are exposed to higher reputational risks.	WWF & TNC (2015). Freshwater Ecoregions of the World.
10.2 - Freshwater Biodiversity Richness (rank)	150	The underlying data set for this risk indicator comes from the Freshwater Ecoregions of the World (FEOW) 2015 data developed by WWF and TNC. Count of fish species is used as a representation of freshwater biodiversity richness. Companies operating in basins with higher number of fish species are exposed to higher reputational risks.	WWF & TNC (2015). Freshwater Ecoregions of the World.
11.1 - National Media Coverage (score)	2.00	This risk indicator is based on joint qualitative research by WWF and Tecnoma (Typsa Group). It indicates how aware local residents typically are of water-related issues due to national media coverage. The status of the river basin (e.g., scarcity and pollution) is taken into account, as well as the importance of water for livelihoods (e.g., food and shelter).	WWF & Tecnoma (TYPSA Group)
11.1 - National Media Coverage (rank)	187	This risk indicator is based on joint qualitative research by WWF and Tecnoma (Typsa Group). It indicates how aware local residents typically are of water-related issues due to national media coverage. The status of the river basin (e.g., scarcity and pollution) is taken into account, as well as the importance of water for livelihoods (e.g., food and shelter).	WWF & Tecnoma (TYPSA Group)
11.2 - Global Media Coverage (score)	2.00	This risk indicator is based on joint qualitative research by WWF and Tecnoma (Typsa Group). It indicates how aware people are of water-related issues due to global media coverage. Familiarity to and media coverage of the region and regional water-related disasters are taken into account.	WWF & Tecnoma (TYPSA Group)
11.2 - Global Media Coverage (rank)	82	This risk indicator is based on joint qualitative research by WWF and Tecnoma (Typsa Group). It indicates how aware people are of water-related issues due to global media coverage. Familiarity to and media coverage of the region and regional water-related disasters are taken into account.	WWF & Tecnoma (TYPSA Group)

Water Risk Filter

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Indicator	Value	Description	Source
12.1 - Conflict News Events (RepRisk) (score)	2.00	This risk indicator is based on 2018 data collected by RepRisk on counts and registers of documented negative incidents, criticism and controversies that can affect a company's reputational risk. These negative news events are labelled per country and industry class.	RepRisk & WWF (2019). Due diligence database on ESG and business conduct risks. RepRisk.
12.1 - Conflict News Events (RepRisk) (rank)	115	This risk indicator is based on 2018 data collected by RepRisk on counts and registers of documented negative incidents, criticism and controversies that can affect a company's reputational risk. These negative news events are labelled per country and industry class.	RepRisk & WWF (2019). Due diligence database on ESG and business conduct risks. RepRisk.
12.2 - Hydro-political Risk (score)	2.32	This risk indicator is based on the assessment of hydro-political risk by Farinosi et al. (2018). More specifically, it is based on the results of spatial modelling by Farinosi et al. (2018) that determined the main parameters affecting water cross-border conflicts and calculated the likelihood of hydro-political issues.	Farinosi, F., Giupponi, C., Reynaud, A., Ceccherini, G., Carmona-Moreno, C., De Roo, A., ... & Bidoglio, G. (2018). An innovative approach to the assessment of hydro-political risk: A spatially explicit, data driven indicator of hydro-political issues. Global environmental change, 52, 286-313.
12.2 - Hydro-political Risk (rank)	95	This risk indicator is based on the assessment of hydro-political risk by Farinosi et al. (2018). More specifically, it is based on the results of spatial modelling by Farinosi et al. (2018) that determined the main parameters affecting water cross-border conflicts and calculated the likelihood of hydro-political issues.	Farinosi, F., Giupponi, C., Reynaud, A., Ceccherini, G., Carmona-Moreno, C., De Roo, A., ... & Bidoglio, G. (2018). An innovative approach to the assessment of hydro-political risk: A spatially explicit, data driven indicator of hydro-political issues. Global environmental change, 52, 286-313.
Population, total (#)	18430453	Population, total	The World Bank 2018, Data , hompage accessed 20/04/2018
GDP (current US$)	0	GDP (current US$)	The World Bank 2018, Data , hompage accessed 20/04/2018
EPI 2018 score (0-100)	0.00	Environmental Performance Index	
WGI -Voice and Accountability (0-100)	0.00	Water Governance Indicator	Kaufmann, Daniel and Kraay, Aart and Mastruzzi, Massimo, The Worldwide Governance Indicators: Methodology and Analytical Issues (September 2010). World Bank Policy Research Working Paper No. 5430. Available at SSRN: https://ssrn.com/abstract=1682132

Indicator	Value	Description	Source
WGI -Political stability no violence (0-100)	1.48	Water Governance Indicator	Kaufmann, Daniel and Kraay, Aart and Mastruzzi, Massimo, The Worldwide Governance Indicators: Methodology and Analytical Issues (September 2010). World Bank Policy Research Working Paper No. 5430. Available at SSRN: https://ssrn.com/abstract=1682132
WGI - Government Effectiveness (0-100)	1.92	Water Governance Indicator	Kaufmann, Daniel and Kraay, Aart and Mastruzzi, Massimo, The Worldwide Governance Indicators: Methodology and Analytical Issues (September 2010). World Bank Policy Research Working Paper No. 5430. Available at SSRN: https://ssrn.com/abstract=1682132
WGI - Regulatory Quality (0-100)	3.85	Water Governance Indicator	Kaufmann, Daniel and Kraay, Aart and Mastruzzi, Massimo, The Worldwide Governance Indicators: Methodology and Analytical Issues (September 2010). World Bank Policy Research Working Paper No. 5430. Available at SSRN: https://ssrn.com/abstract=1682132
WGI - Rule of Law (0-100)	0.96	Water Governance Indicator	Kaufmann, Daniel and Kraay, Aart and Mastruzzi, Massimo, The Worldwide Governance Indicators: Methodology and Analytical Issues (September 2010). World Bank Policy Research Working Paper No. 5430. Available at SSRN: https://ssrn.com/abstract=1682132
WGI - Control of Corruption (0-100)	2.40	Water Governance Indicator	Kaufmann, Daniel and Kraay, Aart and Mastruzzi, Massimo, The Worldwide Governance Indicators: Methodology and Analytical Issues (September 2010). World Bank Policy Research Working Paper No. 5430. Available at SSRN: https://ssrn.com/abstract=1682132

Country Overview - Syria

Indicator	Value	Description	Source
WRI BWS all industries (0-5)	3.85	WRI Baseline Water Stress (BWS)	Gassert, F., P. Reig, T. Luo, and A. Maddocks. 2013. "Aqueduct country and river basin rankings: a weighted aggregation of spatially distinct hydrological indicators." Working paper. Washington, DC: World Resources Institute, December 2013. Available online at http://wri.org/publication/aqueduct-country-river-basin-rankings.
WRI BWS Ranking (1=very high)	38	WRI Baseline Water Stress (BWS)	Gassert, F., P. Reig, T. Luo, and A. Maddocks. 2013. "Aqueduct country and river basin rankings: a weighted aggregation of spatially distinct hydrological indicators." Working paper. Washington, DC: World Resources Institute, December 2013. Available online at http://wri.org/publication/aqueduct-country-river-basin-rankings.
Baseline Water Stress (BWS) - 2020 BAU (1=very high)	20	WRI country ranking	Luo, T., R. Young, and P. Reig. 2015. "Aqueduct projected water stress rankings." Technical note. Washington, DC: World Resources Institute, August 215. Available online at http://www.wri.org/publication/aqueduct-projected-water-stress-country-rankings.
Baseline Water Stress (BWS) - 2020 Optimistic (increasing rank describes lower risk)	21	WRI country ranking	Luo, T., R. Young, and P. Reig. 2015. "Aqueduct projected water stress rankings." Technical note. Washington, DC: World Resources Institute, August 215. Available online at http://www.wri.org/publication/aqueduct-projected-water-stress-country-rankings.
Baseline Water Stress (BWS) - 2020 Pessimistic (increasing rank describes lower risk)	20	WRI country ranking	Luo, T., R. Young, and P. Reig. 2015. "Aqueduct projected water stress rankings." Technical note. Washington, DC: World Resources Institute, August 215. Available online at http://www.wri.org/publication/aqueduct-projected-water-stress-country-rankings.

Indicator	Value	Description	Source
Baseline Water Stress (BWS) - 2030 BAU (increasing rank describes lower risk)	22	WRI country ranking	Luo, T., R. Young, and P. Reig. 2015. "Aqueduct projected water stress rankings." Technical note. Washington, DC: World Resources Institute, August 215. Available online at http://www.wri.org/publication/aqueduct-projected-water-stress-country-rankings.
Baseline Water Stress (BWS) - 2030 Optimistic (increasing rank describes lower risk)	21	WRI country ranking	Luo, T., R. Young, and P. Reig. 2015. "Aqueduct projected water stress rankings." Technical note. Washington, DC: World Resources Institute, August 215. Available online at http://www.wri.org/publication/aqueduct-projected-water-stress-country-rankings.
Baseline Water Stress (BWS) - 2030 Pessimistic (increasing rank describes lower risk)	22	WRI country ranking	Luo, T., R. Young, and P. Reig. 2015. "Aqueduct projected water stress rankings." Technical note. Washington, DC: World Resources Institute, August 215. Available online at http://www.wri.org/publication/aqueduct-projected-water-stress-country-rankings.
Baseline Water Stress (BWS) - 2040 BAU (increasing rank describes lower risk)	25	WRI country ranking	Luo, T., R. Young, and P. Reig. 2015. "Aqueduct projected water stress rankings." Technical note. Washington, DC: World Resources Institute, August 215. Available online at http://www.wri.org/publication/aqueduct-projected-water-stress-country-rankings.
Baseline Water Stress (BWS) - 2040 Optimistic (increasing rank describes lower risk)	24	WRI country ranking	Luo, T., R. Young, and P. Reig. 2015. "Aqueduct projected water stress rankings." Technical note. Washington, DC: World Resources Institute, August 215. Available online at http://www.wri.org/publication/aqueduct-projected-water-stress-country-rankings.
Baseline Water Stress (BWS) - 2040 Pessimistic (increasing rank describes lower risk)	25	WRI country ranking	Luo, T., R. Young, and P. Reig. 2015. "Aqueduct projected water stress rankings." Technical note. Washington, DC: World Resources Institute, August 215. Available online at http://www.wri.org/publication/aqueduct-projected-water-stress-country-rankings.

Water Risk Filter

Country Overview - Syria

Indicator	Value	Description	Source
Total water footprint of national consumption (m3/a/cap)	2107.20	WFN Water Footprint Data	Mekonnen, M.M. and Hoekstra, A.Y. (2011) National water footprint accounts: The green, blue and grey water footprint of production and consumption, Value of Water Research Report Series No. 50, UNESCO-IHE, Delft, the Netherlands.http://www.waterfootprint.org/Reports/Report50-NationalWaterFootprints-Vol1.pdf
Ratio external / total water footprint (%)	15.89	WFN Water Footprint Data	Mekonnen, M.M. and Hoekstra, A.Y. (2011) National water footprint accounts: The green, blue and grey water footprint of production and consumption, Value of Water Research Report Series No. 50, UNESCO-IHE, Delft, the Netherlands.http://www.waterfootprint.org/Reports/Report50-NationalWaterFootprints-Vol1.pdf
Area equipped for full control irrigation: total (1000 ha)	1341.00	Aquastat - Irrigation	FAO. 2016. AQUASTAT website. Food and Agriculture Organization of the United Nations (FAO). Website accessed on 2018/04/13
Area equipped for irrigation: total (1000 ha)	1341.00	Aquastat - Irrigation	FAO. 2016. AQUASTAT website. Food and Agriculture Organization of the United Nations (FAO). Website accessed on 2018/04/13
% of the area equipped for irrigation actually irrigated (%)	95.50	Aquastat - Irrigation	FAO. 2016. AQUASTAT website. Food and Agriculture Organization of the United Nations (FAO). Website accessed on 2018/04/13
Electricity production from hydroelectric sources (% of total)	13.81	World Development Indicators	The World Bank 2018, Data , hompage accessed 20/04/2018
Total internal renewable water resources (IRWR) (10^9 m3/year)	7.13	Aquastat - Water Ressources	FAO. 2016. AQUASTAT website. Food and Agriculture Organization of the United Nations (FAO). Website accessed on 2018/04/13
Total internal renewable water resources (IRWR) (10^9 m3/year)	0.00	Aquastat - Water Ressources	FAO. 2016. AQUASTAT website. Food and Agriculture Organization of the United Nations (FAO). Website accessed on 2018/04/13
Water resources: total external renewable (10^9 m3/year)	0.00	Aquastat - Water Ressources	FAO. 2016. AQUASTAT website. Food and Agriculture Organization of the United Nations (FAO). Website accessed on 2018/04/13

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Indicator	Value	Description	Source
Total renewable water resources (10^9 m3/year)	0.00	Aquastat - Water Ressources	FAO. 2016. AQUASTAT website. Food and Agriculture Organization of the United Nations (FAO). Website accessed on 2018/04/13
Dependency ratio (%)	0.00	Aquastat - Water Ressources	FAO. 2016. AQUASTAT website. Food and Agriculture Organization of the United Nations (FAO). Website accessed on 2018/04/13
Total renewable water resources per capita (m3/inhab/year)	0.00	Aquastat - Water Ressources	FAO. 2016. AQUASTAT website. Food and Agriculture Organization of the United Nations (FAO). Website accessed on 2018/04/13
World happiness [0-8]	3.46	WorldHappinessReport.org	World Happiness Report, homepage accessed 20/04/2018

Country Aspects

1. PHYSICAL ASPECTS

1.1. WATER RESOURCES

1.1.1. WATER RESOURCES

It is estimated that water resources generated from rain falling in the Syrian Arab Republic amount to about 7.1km3/yr. Internal renewable surface water resources are estimated at 4.3km3/yr and groundwater recharge at 4.8km3/yr, of which 2km3/yr discharges into rivers as spring water (overlap between surface water and groundwater).

There are seven main hydrographic basins: Al Jazeera, Aleppo (Quaick and Al Jabbool sub-basins), Al Badia (Palmyra, Khanaser, Al Zelf, Wadi el Miah, Al Rassafa, Al Talf and Assabe'biar sub-basins), Horan or Al Yarmook, Damascus, Asi-Orontes and Al Sahel. Rainfall and snowfall are the major water supply for the basins, except for Al Jazeera and Asi-Orontes, which have their main sources in neighbouring countries. There are 16 main rivers and tributaries in the country, of which six are main international rivers:

-The Euphrates (Al Furat), which is the Syrian Arab Republic's largest river. It comes from Turkey and flows to Iraq. It is 2,330km long, 680km of which is in the Syrian Arab Republic;

-The Afrin in the northwest of the country, which comes from Turkey, crosses the Syrian Arab Republic and flows back to Turkey;

-The Asi-Orontes in the western part of the country, coming from Lebanon and flowing into Turkey;

-The Yarmouk in the southwest, with sources in the Syrian Arab Republic and Jordan. It forms the border between these two countries before flowing into the Jordan river;

-The El-Kabir with sources in the Syrian Arab Republic and Lebanon. It forms the border between them before flowing into the sea;

-The Tigris, which forms the border between the Syrian Arab Republic and Turkey in the extreme northeastern part of the country.

Total actual renewable water resources are estimated at 16.797km3/yr. The natural average surface runoff to the Syrian Arab Republic from international rivers is estimated at 28.515km3/yr. The actual external renewable surface water resources are 17.335km3/yr, which includes 15.750km3 of water entering with the Euphrates, as unilaterally proposed by Turkey; 0.335km3 of water entering with the Asi-Orontes, as agreed with Lebanon; and 1.250km3/yr from the Tigris. The Tigris has a total mean annual flow of 18km3, but since it only borders the country over a short distance in the east, very little is available for the Syrian Arab Republic and a figure of 1.250km3/yr is given (Abed Rabboh, 2007). Total actual groundwater inflow has been estimated at 1.33km3/yr, of which 1.20km3 is from Turkey and 0.13km3 from Lebanon (Dan springs). Groundwater outflow to Israel and Jordan is estimated at 0.25 and 0.09km3/yr respectively.

The main groundwater aquifers are those of Anti-Lebanon and the Alouite Mountains. Folding and faulting of the geological layers has resulted in the mingling of the subaquifer systems. There are a number of springs discharging from this aquifer system, such as the Ari-Eyh, Barada, Anjar-Chamsine and Ras El-Ain. Recharge to the system occurs from intense precipitation in the mountainous regions, which infiltrates through the fractures and fissures of the karstified surface layer. Water quality ranges from 175 to 900ppm.

Another significant aquifer system is the Damascus plain aquifers, extending from the Anti-Lebanon Mountains in the west to the volcanic formations in the south and east. This system is composed of gravel and conglomerates with some clay, and is represented by riverbeds and alluvial fan deposits up to 400m thick. Groundwater quality ranges from 500 to more than 5,000ppm. The major carbonate Haramoun mountain aquifer is located between Lebanon and the Syrian Arab Republic. The main discharging springs are those of the Banias and Dan tributaries of the Jordan river basin. Groundwater quality is estimated at 250ppm. Other aquifers with limited potential are located in the desert areas. These consist of marl and chalky limestone of the Paleogene age. Recharge occurs mainly from flood flow. Water quality ranges from 500 to 5,000 ppm depending on the source of recharge (ESCWA, 2001).

There are 166 dams in the Syrian Arab Republic with a total storage capacity of 19.7km3. The largest is the Al Tabka dam, located near Ar Raqqah on the Euphrates and forming the Al Assad Lake. It has a storage capacity of 14.1km3 and a surface area of 674km2. Medium-size dams include the Al Rastan (228 million m3), the Qattinah (200 million m3), the Mouhardeh (67 million m3) and the Taldo (15 million m3). The majority of these dams are located near Hims and Hamah in the western part of the country (ESCWA, 2001).

In 2002, total wastewater produced in the Syrian Arab Republic was 1,364 million m3. The towns of Damascus, Aleppo, Hims and Salamieh mainly carried out treatment of municipal wastewater and it reached 550 million m3 in 2002. All treated wastewater is reused. Reused treated wastewater totalled 330 million m3 in 2002, an increase of 49 per cent since 1993. The production of desalinated water in the Syrian Arab Republic is marginal. The installed gross desalination capacity (design capacity) is 8,183 m3/day, which is less than 3 million m3/yr (Wangnick Consulting, 2002).

1.1.2. WATER USE

Total annual water withdrawal in the Syrian Arab Republic was estimated at 16.69 km3/yr in 2003, 87.9 per cent of which was for agricultural purposes. From 1993 to 2003, total water withdrawal increased by almost 31 per cent. Agricultural water withdrawal followed the same trend, and municipal and industrial withdrawal increased by 39 and 89 per cent respectively.

In 1999, the Euphrates and Asi-Orontes basins accounted for about 50 and 20 per cent of total water withdrawal respectively (Salman, 2004).

According to Salman and Mualla (2003), total estimated water use in the Syrian Aran Republic is about 15 billion m3. The Euphrates and Orontes basins account for about 50 per cent and 20 per cent of water use respectively. Water balance in most basins has been in deficit (except in the coastal basin and the Euphrates basin). This will continue to worsen, especially in basins encompassing large urban areas such as Damascus and Aleppo.

Agriculture is the largest water consuming sector in the Syrian Aran Republic, accounting for about 87 per cent of all water use. Domestic and industrial water use stands at about 9 per cent and 4 per cent respectively. While urban water demands are rapidly increasing due to the population growing around 3 per cent per year and industrial growth, new water sources are becoming scarce and extremely expensive to develop. Water deficits are expected to worsen. Since drinking water needs are given top priority in the government's policy, water for agricultural use could face severe constraints (Salman and Mualla, 2003).

Pressure on water resources comes from all sectors of the economy, with the highest demand from agriculture. In 2000, the area of cultivated land in the Syrian Aran Republic was estimated at 55,000km2, covering about 30 per cent of the country's total area. Twenty per cent of this cultivated land area (12,000km2) was irrigated. The Euphrates and the Orontes basins make up the major share. The total irrigated area increased from 6,500km2 in 1985 to 13,000km2 in 2002 (Somi et al, 2001 and 2002). This rapid expansion of irrigated agriculture is mainly attributed to the government policy objective of achieving food self-sufficiency and the remarkable increase in groundwater irrigation (Salman and Mualla, 2003).

The government's policies have encouraged cereal and cotton production as a mechanism for ensuring the country's self-sufficiency (Salman and Mualla, 2003). The notion of self-sufficiency was recently redefined into a more flexible concept designed to increase production of certain crops that profit from comparative advantage. Thus exports of these products can counterbalance the need to import other commodities (Sarris, 2001). The production of selective crops, especially wheat and cotton, has shown marked improvement when comparing consumption. The ratio of production/consumption for wheat has increased from 0.51 in 1989 to 1.41 in 1997. For cotton, it increased from 1.56 to 1.74 during the same period (World Bank, 2001).

This high level of self-sufficiency and increased production of selective crops appears, however, to have come at the expense of unsustainable water use patterns (Salman and Mualla, 2003).

Groundwater use, particularly for irrigation, has increased dramatically over the last two decades. Sixty per cent of all irrigated areas in the Syrian Aran Republic are currently irrigated by groundwater. Most are privately developed and operated (Salman and Mualla, 2003).

A substantial portion of the increase in groundwater use is related to increases in irrigation for wheat, cotton, citrus and sugar beet. The area used to grow these crops has increased significantly in the last decade: sugar beet area has grown by 32 per cent, cotton by 75 per cent, irrigated wheat by 40 per cent and citrus by 40 per cent. Much of the expansion in wheat has been driven by rapid expansions of its price while water cost has remained low. Farmers from public irrigation schemes obtain water at an extremely subsidized rate, and groundwater costs do not reflect their real value because the energy required for pumping is also subsidized (Rodriguez et al, 1999) (Salman and Mualla, 2003).

Government policies have contributed to the tremendous increase in groundwater irrigation. Wheat supported prices which have been higher than world prices for several years, coupled with subsidized energy costs, have proven to be a strong incentive for farmers to take up groundwater irrigation in many areas (Salman and Mualla, 2003).

This great expansion of groundwater-irrigated agriculture has resulted in groundwater being overexploited in most of the country's basins. Continuous decline in groundwater tables has affected some surface sources, such as spring flows, and caused seawater intrusion in land areas adjacent to the sea (Salman and Mualla, 2003).

Traditionally, surface water has been developed widely in most basins and a large share of surface water is supplied by dams. Though there still remains some potential for further development of dams and growth of storage volume, the cost for such exploitation is considered extremely high (Salman and Mualla, 2003).

Except for the Euphrates, most of the irrigation schemes' distribution system is with low conveyance efficiency that does not exceed 40-50 per cent. Even with the Euphrates basin's irrigation schemes' concrete lined canals, the conveyance efficiency still does not exceed 60-70 per cent due to evaporation and poor maintenance (Salman et al, 1999). To improve the conveyance efficiency and to provide more reliable water supply to the fields, the Ministry of Irrigation has planned to convert the old open surface distribution system into a pipeline system and rehabilitate new lined canal systems (Salman and Mualla, 2003).

Surface gravity system is the prevailing irrigation system at field level, covering about 95 per cent of the irrigated area in the Syrian Aran Republic. Basin irrigation is the predominant method used for wheat and barley. On-farm water use efficiency is low in general (40-60 per cent) due to over-irrigation using traditional basin irrigation method. Even with cotton and vegetables, which are irrigated by furrows, the efficiency is still low due to the lack or inadequacy of land levelling. Thus, there seems to be considerable scope to increase the efficiency of water use at field level by introducing advanced on-farm irrigation techniques such as drip and sprinkler irrigation or by improving on-farm water management and water conservation (Salman and Mualla, 2003).

1.2. WATER QUALITY, ECOSYSTEMS AND HUMAN HEALTH

Monitoring activities show that municipal and industrial waste pollutes nearly all major settlements' groundwater and surface water. Concentrations of biochemical oxygen demand, suspended solids and ammonia exceed Syrian standards, and groundwater in the basin also contains extremely high concentrations of pathogens, nitrates and agrochemicals. This situation occurs in many areas (MLAE, 2007):

-Water pollution from sewage water is reported in the Barada River;

-An increase in the amount of nitrates and ammonia ions has been noted in some drinking wells in the Damascus countryside (Ghouta), over the permitted level. In 2005 this led to investment in more than 200 wells for drinking being stopped;

-Uncontrolled discharge of industrial wastewater occurs on a large scale. The fertilizer and food

processing industries contribute to the pollution load, but smaller and medium-sized industries, such as tanneries, also contribute and their impacts are larger;
-Drainage water from irrigated agriculture, containing excessive nutrients, pesticides and sometimes (in the case of irrigation with untreated wastewater) pathogens, reaches rivers and groundwater;
-In areas with heavy groundwater extraction, saltwater intrusion into the aquifer from the sea or other saline groundwater has occurred.
There is evidence to indicate that water pollution has caused significant health impacts. The following cases have been reported (MLAE, 2007):
-Almost 900,000 cases of waterborne diseases were reported in 1996, and a significant number went unreported;
-High rates of infantile diarrhoea, with fatality rates of up to 10 per cent within some illegal housing areas not served by a drinking water network.
Compared to 1991-95, during the period 1995-2000 the rate of typhoid and hepatitis infections increased tenfold and that of diarrhoea doubled. Diseases such as tapeworm and pulmonary tuberculosis also affected animals, due to the use of untreated wastewater for fodder crop irrigation. The major factors favouring the development and dispersion of these diseases can be summarized as follows (DIWU, 2003):
-Scarcity of groundwater resources and the tendency to use wastewater to solve the shortage;
-Lack of infrastructure, especially related to wastewater treatment and disposal, for example, random disposal without treatment most of the time;
-Lack of health awareness and proper handling of polluted water;
-Non-existence or lack of adoption of regulations related to the protection of the environment and public health.
The cost of environmental degradation in the Syrian Arab Republic was estimated to be 2.6-4.1 per cent of GDP annually in 2004, based on 2001 figures, with a mean estimate of around US$600 million/yr, according to the Mediterranean Environmental Technical Assistance Program/World Bank. Estimated costs of damage are organized by environmental category. The cost of diarrhoea illness and mortality follows at an estimated 0.6-0.7 per cent of GDP, caused by lack of access to safe potable water and sanitation, and inadequate domestic, personal and food hygiene. The total cost of water resource degradation, and inadequate potable water, sanitation and hygiene, is estimated at 0.7-1.0 per cent of GDP (MLAE, 2007).
According to the United Nations Economic and Social Commission for Western Asia (ESCWA) (2004), Normative Standard 45 of 1973 was the Syrian Arab Republic's first drinking water standard. It covered a number of aspects: radioactive materials, physical characteristics, chemical characteristics, chemical toxicity, bacterial toxicity, standardized sampling methods and sampling frequencies. The standard was subsequently amended, and a final formulation of draft normative standards for drinking water in the Syrian Arab Republic was adopted and promulgated under the title Drinking Water Quality in 1996. There are normative standards for wastewater as well, which govern effluent from economic activities that is discharged into public sewer systems. These standards, adopted in 1996, established permissible pollutant levels with a view to ensuring that wastewater treatment plants could function adequately and that treated wastewater would be suitable for irrigation purposes.

2. GOVERNANCE ASPECTS

2.1. WATER INSTITUTIONS

Responsibility for water resources management lies with a number of ministries, which are all represented on the Council of General Commission for Water Resource Management:
-The Ministry of Irrigation (MOI) is the central institution for managing, developing and protecting water resources, supervising investments and drawing up strategic plans for executing water policies to achieve sustainable development of resources. The ministry is responsible for making suitable water resources available for all water using sectors, for controlling drilled wells and for licensing future wells.
-The Ministry of Agriculture and Agrarian Reform (MAAR) is the main consumer of water resources; it is responsible for the rational use of water for agricultural purposes, for minimizing water consumption and encouraging the use of modern irrigation techniques. The Council of Ministers agreed (in 2005) to establish a national monetary fund for modern irrigation projects.
-The Ministry of Housing and Construction (MHC) is responsible for supplying drinking water from surface and underground water resources by building, operating and investing in the water networks and water purification stations as well as building sewage water networks and treatment plants, and enhancing the efficiency of water and sewage networks.
-The Ministry of Local Administration and Environment (MLAE) is responsible for monitoring and controlling water quality through its laboratories and observatory networks, for issuing national standards for the protection of water resources and tracking the sources of pollution to implement environmental law.
Each ministry has local bodies (local directorates or local institutions) related to the central body of each Ministry and distributed over the 14 administrative units. In the case of the MOI there is the General Commission for Water Resources as a central body within the ministry and in the case of the MLAE, there is the General Commission for Environmental Affairs (MLAE, 2007).

2.2. WATER MANAGEMENT

Research, testing, piloting and demonstration programmes for on-farm irrigation techniques, scheduling and wastewater reuse are under the jurisdiction of the Directorate of Irrigation and Water Use of the MAAR, although farmers are responsible for irrigation management at field level. The MAAR has 13 irrigation and water use research stations in all basins so they can conduct research and disseminate information on crop water requirements and optimized irrigation methods suitable for local conditions. The MAAR also gives farmers technical support for the planning, design and maintenance of on-farm irrigation systems (World Bank, 2001).
Between 2005 and 2006, the International Programme for Technology and Research in Irrigation

and Drainage carried out the Project Design and Management Training Programme for Professionals in the Water Sector in some Near East countries, including the Syrian Arab Republic. The programme's objective was to strengthen participants' capacity to develop effective and efficient projects to address pressing water issues in the region (FAO, 2008).

Ninety-five per cent of the population in urban areas and 80 per cent in rural areas have access to safe potable water. Urban and rural water supply and sanitation facilities have been enlarged and upgraded regularly to accommodate the expanding population. Water balance in most basins has been in deficit. This will be exacerbated in basins encompassing large urban cities like Aleppo and Damascus, putting more pressure on water use for agriculture. The Barada/Awaj basin, where Damascus is located, has no significant water sources, neither surface nor groundwater, other than the Barada and Figeh springs, which supply drinking water to the inhabitants of Damascus. As most of the basin's water resources are continuously dedicated to support Damascus's increasing demand for drinking water, internal conflict over water has arisen. Farmers in the Damascus countryside, who have been using groundwater to irrigate their lands for years, have protested about their wells drying up because of massive groundwater extraction.

Water pricing is viewed as an economic instrument to improve water allocation. Water has two types of price: the supply cost and the economic cost. The supply cost is the cost of operating and maintaining water utilities. It can also include investment cost and interest and depreciation on borrowed capital. The economic cost may include the opportunity cost relating to the fact that water should be allocated to its highest value uses to maximize social welfare, adding to that the resource cost arising if water is economically scarce. In addition to supply and economic considerations, to present the full cost of water, we must take into account that a certain use of water may impose costs on other users (social costs) and that environmental damage costs arise if water is used (environmental damage costs). Almost nowhere do farmers pay anything near the supply cost of water, let alone its economic cost (Bazza and Ahmad, 2002; Roth, 2001).

Because water in general and irrigation water in particular often require large initial capital investments in infrastructure development, governments are often required to allocate water resources using various mechanisms, some more efficient and easier to implement than others (Dinar, 1998). Decision-makers generally involve water pricing of one sort or another. Yet, and against any rational expectation, irrigation water prices in most of the countries of the Middle East are low and reflect neither the scarcity of the resources nor the important investments required in the mobilization of water. In fact, since the 1960s and 1970s, economic and urban development has compelled public authorities to promote irrigated agriculture as the unique way to satisfy the food needs of explosively increasing populations. This policy included essentially providing water at low prices, largely less than mobilization costs and with increasing subsidies (Salman and Mualla, 2003).

Choosing an option to manage water demand in the agricultural sector is highly dependent on the type of the water source, whether it is ground or surface water. It also depends on the history of management as well as the local conditions: social, economical and political. Taxation, perhaps associated with other management alternatives, may be well adapted for the management of groundwater. In the case of the Syrian Aran Republic, where groundwater is probably the country's most prominent water management challenge, with threatening levels of depletion and possible future non-sustainability, taxation may be the wiser way to plan the exploitation of this resource for the long term. However, this option may be difficult to implement. A high rate of taxation could damage the well-being of users, and would need to be enforced. It may be more effective to combine taxation with other options such as a community-based approach to groundwater management, or something similar to the adjusted subsidies on electric energy and diesel fuel that are commonly used to operate groundwater (Salman and Mualla, 2003).

Water markets tend to be more suitable for surface water when physical transfers are possible. However, one must not expect large-scale results from this option, at least in the short term. Preliminary preparation before implementing such an option is certainly needed. This involves preparing the necessary infrastructure, such as a distribution network and quotas, making users more accepting of developing water markets and fighting against cultural reluctance (ethical influences). The first preparatory action may involve high costs and in some cases may not be justified compared with expected outcomes, while the result of the second is not predictable. An appropriate "environment" for active water markets that combines both water scarcity and heterogeneity among farmers is a prerequisite for successful results (Salman and Mualla, 2003).

In the case of the Syrian Aran Republic, the notion has not yet been addressed officially, though informal practices are showing that application could be possible, in particular in critical basins ripe for this option. As an alternative to water markets, optimal centralized policy is proposed to manage surface water demand. However, this policy can only be effective if it is embedded into an integrated set of measures that create the synergy necessary to achieve the anticipated objectives (technical, institutional, legal, economic and social). It also requires necessary reforms on all fronts (Salman and Mualla, 2003).

2.3. WATER POLICY AND LEGAL FRAMEWORK

Water is defined by Syrian law as a "public good" that is not treated according to market forces. The right to use surface water or groundwater is acquired by applying for water use licenses from the MOI. Installing a pump on public surface water without a licence leads to a nominal fine. The licence can be withdrawn if users do not comply with its conditions or if they use the water for purposes other than those authorized. At present, licences specify discharge, well numbers and a maximum depth of 150m. They are issued for periods of either 1-3 years or 10 years. A law banning new wells has been in place for more than five years. This law allows the repair of problematic wells but prohibits new constructions. However, enforcement of this law is weak.

The government has passed over 140 laws dealing with water since 1924. However, no official legislation has set water use priorities. Nonetheless, there is a widely accepted consensus among relevant ministries about priorities for water use. Drinking water is top priority, followed by agricultural and industrial water. The government has passed bans on well digging and groundwater pollution but there are no clear mechanisms for their enforcement (Salman, 2004).

According to ESCWA (2004), water strategies and policies in the Syrian Arab Republic's five-year development plans have three objectives: to provide people with clean water that is safe to drink, to achieve food self-sufficiency, and to make the best possible use of every drop of water.

In pursuit of those objectives, water policies outline proposed measures including surface water and groundwater resource development to meet the needs of the expanding land area under cultivation. This is seen as a means to long-term self-sufficiency, the construction of dams for flood control, action to meet irrigation needs, the upgrading of water quality, and encouragement for the reuse of treated wastewater (ESCWA, 2004).

Some of the region's countries (Egypt, Iraq, Jordan, the Syrian Arab Republic and Yemen) have developed policies for sectors in which water is a factor (agriculture, energy, industry, land use and intraregional, for example), while other countries have not yet developed policies for those sectors and coordinated them with water sectors (ESCWA, 2004).

According to ESCWA (2005), the main water resources-related legislation in the Syrian Arab Republic is:

•Resolution No. 1216 of the Ministry of Irrigation protecting sources of Jorat Alhisan against pollution (23 May 2001);

•Resolution No. 22 of the High Agricultural Council carrying out the Ministry of Irrigation to authorize the exploited and unauthorized wells (30 April 2001);

•Resolution No. 13 of the High Agricultural Council creating a committee for studying the unauthorized excavated wells for potable waters (25 February 2001);

•Resolution No. 31 of the High Agricultural Council issuing irrigation licence (21 October 2000);

•Resolution No. 2165 of the Ministry of Irrigation defining the maximum quantity of authorized waters and the areas, which should be irrigated by this quantity (16 August 2000);

•Resolution No. 2166 obligating the owners of the authorized wells to install counters on the pumps (16 August 2000);

•Resolution No. 11 of the High Agricultural Council concerning the irrigation method (5 July 2000);

•Resolution No. 3796 defining the boundary of Basel Dam Lake with the objective to prevent pollution (3 December 1998);

•Resolution No. 187 adopting the Standardization No. 1712 concerning the rubber hydrants used for discharge and absorption of water as a Syrian Standardization and Metrology (3 September 1998);

•Resolution No. 1988 creating 3 offices for irrigation into the Ministry of Irrigation (9 July 1998);

•Resolution No. 3412 of the Minister of Housing and Public Utilities fixing the tariff of cubic meter of drinking water (30 November 1996);

•Law on Environmental Protection and Development of March 1994 (March 1994).

3. GEOPOLITICAL ASPECTS

In 1955, the Syrian Arab Republic and Jordan signed an agreement about the allocation of the Yarmouk River's water. This was revised in 1987. A recent agreement between Lebanon and the Syrian Arab Republic about the Asi-Orontes River has led to a share of 80 million m3/yr for Lebanon and 335 million m3 for the Syrian Arab Republic.

In 1973, the Syrian Arab Republic constructed the Tabqa Dam, which was filled in 1975. The filling of this dam and the Turkish Keban Dam caused a sharp decrease in downstream flow; the quantity of water entering Iraq fell by 25 per cent (El Fadel et al, 2002). Consequently, Iraq and the Syrian Arab Republic exchanged mutually hostile accusations and came dangerously close to a military confrontation (Akanda et al, 2007). Iraq threatened to bomb the dam. Both countries moved troops toward their common border. Saudi Arabia and possibly the Soviet Union mediated. Eventually the threat of war died down, after the Syrian Arab Republic released more water from the dam to Iraq. Although the terms of the agreement were never made public, Iraqi officials have privately stated that the Syrian Arab Republic agreed to take only 40 per cent of the river's water, leaving the remainder for Iraq (Kaya, 1998).

In 1983, Turkey, Iraq and the Syrian Arab Republic established the Joint Technical Committee for Regional Waters, the aim of which was to deal with all water issues among the Euphrates-Tigris basin riparians and to ensure that the procedural principles of consultation and notification were followed as required by international law. However, this group disintegrated after 1993 without making any progress (Akanda et al, 2007).

In 1987, an informal agreement between Turkey and the Syrian Arab Republic guaranteed the latter a minimum flow of the Euphrates River of 500 m3/sec throughout the year (15.75 km3/yr). The Syrian Arab Republic has since accused Turkey of violating this agreement a number of times.

According to an agreement between the Syrian Arab Republic and Iraq signed in 1990, the Syrian Arab Republic agrees to share the Euphrates water with Iraq on a 58 per cent (Iraq) and 42 per cent (the Syrian Arab Republic) basis, which corresponds to a flow of 9 km3/yr at the border with Iraq when using the figure of 15.75 km3/yr from Turkey (FAO, 2004).

The construction of the Ataturk Dam, one of the Southeastern Anatolia projects completed in 1992, has been widely portrayed in the Arab media as a belligerent act, since Turkey began the process of filling the Ataturk dam by shutting off the river flow for a month (Akanda et al, 2007). Both the Syrian Arab Republic and Iraq accused Turkey of not informing them about the cut-off, thereby causing considerable harm. Iraq even threatened to bomb the Euphrates dams. Turkey countered that its co-riparians "had been timely informed that river flow would be interrupted for a period of one month, due to technical necessities" (Kaya, 1998). Turkey returned to previous flow sharing agreements after the dam became operational, but the conflicts were never fully resolved as downstream demands had increased in the meantime (Akanda et al, 2007).

As shown above, a number of crises have occurred in the Euphrates-Tigris basin because of a lack of communication, conflicting approaches, unilateral development, and inefficient water management practices. The Arab countries have long accused Turkey of violating international water laws with regard to the Euphrates and the Tigris rivers. Iraq and the Syrian Arab Republic consider these rivers as international, and thus claim a share of their waters. Turkey, in contrast, refuses to concede the international character of these two rivers and only speaks of the rational utilization of trans-boundary waters. According to Turkey, the Euphrates only becomes an international river after it joins the Tigris in lower Iraq to form the Shatt al-Arab, which then serves as the border between Iraq and the Islamic Republic of Iran until it reaches the Persian Gulf only

193km further downstream. Furthermore, Turkey is the only country in the Euphrates basin to have voted against the United Nations Convention on the Law of Non-navigational Uses of International Watercourses. According to Turkey, if signed, the law would give "a veto right" to the lower riparians over Turkey's development plans. Consequently, Turkey maintains that the Convention does not apply to them and is thus not legally binding (Akanda et al, 2007).

In 2001, the General Organization for Land Development of the government of the Syrian Arab Republic and the GAP Regional Development Administration (GAP-RDA), which works under the Turkish Prime Minister's Office, signed a joint communiqué. This agreement envisions supporting training, technology exchange, study missions and joint projects (Akanda et al, 2007).

In 2002, the Syrian Arab Republic and Iraq signed a bilateral agreement concerning the installation of a Syrian pump station on the Tigris River for irrigation purposes. The quantity of water drawn annually from the Tigris River, when the flow of water is average, shall be 1.25km3 with a drainage capacity proportional to the relative surface area of 1,500km2 (FAO, 2002).

In April 2008, Turkey, the Syrian Arab Republic and Iraq decided to cooperate on water issues by establishing a water institute that will consist of 18 water experts from each country to work toward solving water-related problems among the three countries. The institute will conduct its studies at the Ataturk Dam's facilities, the biggest dam in Turkey, and plans to develop projects for the fair and effective use of transboundary water resources. The Syrian Arab Republic and Turkey have held several talks, during which the countries have decided to jointly construct a dam on the Asi-Orontes River, which originates in the Syrian Arab Republic and flows to the Mediterranean Sea from Turkey's Hatay province (Yavuz, 2008).

The Golan Heights control Israel's main water sources. The area feeds Israel's only lake and its main source of fresh water, supplying the country with a third of its water. The Golan Heights were conquered by Israel in 1967 and have been under Israeli law, jurisdiction and administration since 1981, although the United Nations Security Council has not recognized this.

According to Marina (2010), the Arab region relies heavily on groundwater which is found in a number of shared aquifers such as the basalt aquifer shared by Jordan and the Syrian Aran Republic, the Palaeogene aquifer shared by Oman and the United Arab Emirates, the Disi sandstone aquifer shared by Jordan and Saudi Arabia, and the Nubian Sandstone Aquifer System shared by Chad, Egypt, Libya, and Sudan. As with surface water, the major aquifers in the region are shared between two or more countries. In fact, the majority of territorially contiguous states in the Middle East and North Africa share both renewable or nonrenewable groundwater aquifers.

Lebanon and the Syrian Aran Republic have signed two agreements on their shared rivers, one on the Orontes in 1994 and another on the Nahr Al-Kabir Al Janoubi in 2002 (Marina, 2010).

The Orontes is a shared river with its source in Lebanon, flowing into the Syrian Aran Republic, and ending in Turkey. In 1994, Lebanon and the Syrian Aran Republic signed the Accord Concerning the Distribution of the Orontes. The agreement does not involve Turkey. Negotiations between the Syrian Aran Republic and Turkey did not lead to any result. An annex was added to the Syrian-Lebanese agreement in 1997, which was ratified only in 2001 by the Syrian-Lebanese Higher Council. Under this agreement, a dam was built in Lebanon on the Orontes with a capacity of 37 million m3 (ESCWA, 2006).

The Nahr Al-Kabir Al Janoubi forms Lebanon's northern border with the Syrian Arab Republic. The total river watershed area is about 990km2, of which 295 km2 lies in Lebanon (ESCWA, 2006). Discussions between Lebanon and the Syrian Aran Republic on sharing the waters of the Al-Kabir Al Janoubi river began as discussions on sharing the waters of the Orontes were progressing. They reached an agreement in 2002. The agreement draws on principles from the UN Convention on the Non-Navigational Uses of International Watercourses (21 May 1997), which both Lebanon and the Syrian Aran Republic ratified (Marina, 2010). Its main provisions are based on the articles of this Convention. The focus of the agreement is the fair and optimal distribution of waters of the Nahr Al-Kabir Al Janoubi and it is based on the principle of realizing mutual benefit for the two sides. The agreement has also established a process of cooperation between the two countries through a joint committee to share information and results. Based on identified needs and requirements for both countries in all sectors (potable, irrigation, and industrial), the construction of a joint dam in Idlin (the Syrian Aran Republic)-Noura al-Tahta (Lebanon) was decided, with a storage capacity of 70 million m3, according to technical and economic feasibility studies (ESCWA, 2006).

The agreement is considered to have established a good basis for cooperation between Lebanon and the Syrian Aran Republic. However, financial, administrative, and political problems seem to have held up implementation of the agreement (ESCWA, 2006).

The building of a dam, with a hydropower station, was also the purpose of the agreement between Jordan and the Syrian Aran Republic on the Yarmouk River, the main tributary of the Jordan River. They first signed an agreement in 1953, but it was not implemented and was updated and replaced by a second agreement in 1987. In the second agreement, Jordan and the Syrian Aran Republic agreed to "build the Unity Dam on the Yarmouk River with a height of 100m and a storage capacity of 225 million m3. In 2003, the height of the dam was reduced to 87m and the storage capacity became 110 million m3" (FAO, 2008). The dam was finally inaugurated in 2008.

Because of the political conflict in the region, the case of the Yarmouk cannot be considered completely settled so far. The river is part of the Jordan river basin. It needs therefore to be integrated into an agreement governing the whole drainage basin (Marina, 2010).

Although bilateral agreements, treaties of friendships, joint technical committee meetings and protocols have existed for the cooperative management of the Tigris and Euphrates river basin, Turkey, the Syrian Aran Republic and Iraq have failed so far to come to a far-reaching agreement or framework, particularly "as a result of conflict over the development of Turkey's Southeastern Anatolia Project and the filling of the Ataturk Dam" (ESCWA, 2009). The situation remains tense in this two-river basin as Turkey has pursed its unilateral project. There is plenty of blame to go around, however. In fact, "the Euphrates is so chocked by Turkish, Syrian, and Iraqi dams that the river-end residents of Basra must reach hundreds of kilometres back upstream for their supply" (Zeitoun, 2010).

Another example of cooperation where no formal agreement exists is the case of the Basalt aquifer between Jordan and the Syrian Aran Republic. ESCWA initiated a joint study on this aquifer in 1994, working with the respective water authorities in both countries. In view of pursuing and enhancing the cooperation and coordination between the two countries, a memorandum of understanding (MOU) was prepared in 2002 but never signed (ESCWA, 2006). Today the text of the MOU might need revision, and the study might need to be updated (Marina, 2010).

On 2 April 1998, the Syrian Arab Republic ratified the United Nations Convention on the Law of the Non-Navigational Uses of International Watercourses.

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