Water Risk Filter

Country Overview - Djibouti

Water Indicators

Indicator	Value	Description	Source
Overall Basin Risk (score)	3.21	Overall Basin Risk (score)	
Overall Basin Risk (rank)	12	Overall Basin Risk (rank)	
Physical risk (score)	3.34	Physical risk (score)	
Physical risk (rank)	14	Physical risk (rank)	
Regulatory risk (score)	3.57	Regulatory risk (score)	
Regulatory risk (rank)	24	Regulatory risk (rank)	
Reputation risk (score)	2.47	Reputation risk (score)	
Reputation risk (rank)	122	Reputation risk (rank)	
1. Quantity - Scarcity (score)	3.67	1. Quantity - Scarcity (score)	
1. Quantity - Scarcity (rank)	24	1. Quantity - Scarcity (rank)	
2. Quantity - Flooding (score)	3.98	2. Quantity - Flooding (score)	
2. Quantity - Flooding (rank)	26	2. Quantity - Flooding (rank)	
3. Quality (score)	2.88	3. Quality (score)	
3. Quality (rank)	115	3. Quality (rank)	
4. Ecosystem Service Status (score)	1.83	4. Ecosystem Service Status (score)	
4. Ecosystem Service Status (rank)	142	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)	60	5. Enabling Environment (Policy & Laws) (rank)	
6. Institutions and Governance (score)	4.00	6. Institutions and Governance (score)	
6. Institutions and Governance (rank)	24	6. Institutions and Governance (rank)	
7. Management Instruments (score)	3.53	7. Management Instruments (score)	
7. Management Instruments (rank)	22	7. Management Instruments (rank)	
8 - Infrastructure & Finance (score)	3.90	8 - Infrastructure & Finance (score)	
8 - Infrastructure & Finance (rank)	45	8 - Infrastructure & Finance (rank)	
9. Cultural Diversity (score)	1.00	9. Cultural importance (score)	
9. Cultural Diversity (rank)	124	9. Cultural importance (rank)	
10. Biodiversity Importance (score)	2.87	10. Biodiversity importance (score)	

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Indicator	Value	Description	Source
10. Biodiversity Importance (rank)	143	10. Biodiversity importance (rank)	
11. Media Scrutiny (score)	3.55	11. Media Scrutiny (score)	
11. Media Scrutiny (rank)	20	11. Media Scrutiny (rank)	
12. Conflict (score)	1.57	12. Conflict (score)	
12. Conflict (rank)	183	12. Conflict (rank)	
1.0 - Aridity (score)	4.00	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)	12	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)	2.84	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)	63	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)	2.42	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.

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Indicator	Value	Description	Source
1.2 - Baseline Water Stress (rank)	77	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)	5.00	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)	1	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)	1.40	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)	135	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)	5.00	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)	2	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)	3.00	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) . 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)	70	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)	3.99	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)	43	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)	3.72	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)	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). 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)	2.88	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)	115	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)	1.97	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)	128	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)	1.00	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)	156	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)	3.93	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)	33	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)	40	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)	47	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)	51	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)	4.00	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)	22	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.

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Indicator	Value	Description	Source
6.2 - Freedom in the World Index (rank)	6	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)	48	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)	30	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)	5.00	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)	2	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)	4.53	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)	25	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)	4.00	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)	20	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)	4.00	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)	51	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)	68	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)	1.00	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)	124	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)	4.73	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)	41	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)	1.00	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)	185	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)	4.00	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)	10	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)	3.00	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)	22	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)

Country Overview - Djibouti

Indicator	Value	Description	Source
12.1 - Conflict News Events (RepRisk) (score)	1.00	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)	155	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)	2.13	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)	107	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 (#)	942333	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)	40.04	Environmental Performance Index	
WGI -Voice and Accountability (0-100)	23.81	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)	12.81	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)	16.83	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)	25.48	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 - Rule of Law (0-100)	17.31	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)	30.29	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

Water Risk Filter

Country Overview - Djibouti

Indicator	Value	Description	Source
WRI BWS all industries (0-5)	3.39	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)	51	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)	136	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)	136	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)	134	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.

Country Overview - Djibouti

Indicator	Value	Description	Source
Baseline Water Stress (BWS) - 2030 BAU (increasing rank describes lower risk)	138	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)	137	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)	137	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)	142	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)	132	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)	136	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 - Djibouti

Indicator	Value	Description	Source
Total water footprint of national consumption (m3/a/cap)	0.00	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 (%)	0.00	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)	1.01	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)	1.01	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 (%)	38.34	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)	0.00	World Development Indicators	The World Bank 2018, Data , hompage accessed 20/04/2018
Total internal renewable water resources (IRWR) (10^9 m3/year)	0.30	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)	0.30	Aquastat - Water Ressources	FAO. 2016. AQUASTAT website. Food and Agriculture Organization of the United Nations (FAO). Website accessed on 2018/04/13

Water Risk Filter

Country Overview - Djibouti

Indicator	Value	Description	Source
Total renewable water resources (10^9 m3/year)	0.30	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)	337.90	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]	0.00	WorldHappinessReport.org	World Happiness Report, homepage accessed 20/04/2018

Country Aspects

1. PHYSICAL ASPECTS

1.1. WATER RESOURCES

1.1.1. WATER RESOURCES

The renewable water resources are estimated at 300 million m3/year. The river system is divided into two zones, one draining into the Red Sea or the Gulf of Aden (45 per cent), the other to the plains of western countries (55 per cent). The rivers are not perennial, because of low rainfall, but contribute to groundwater recharge (only the web of Djibouti is currently used). Flows are generally low, with a salt content between 1 and 1.5g/L. Only about 5 per cent of precipitation is likely to infiltrate and recharge the shallow (wadi sediments) or deep (basaltic) aquifers. Although the contribution of Ethiopia is estimated at 2km3/year (Lake Abbe), this volume is not taken into account as it is salt water.

Two continuous aquifers exist in Djibouti, one across the western part of the country, the other in the south between Djibouti City and Loyada. Moreover, there are discontinuous and alluvial layers. Given the nature of the soil, and except for land shared with Ethiopia, groundwater recharge is based on the infiltration of floodwaters in the wadis. It is estimated that the volume of exploitable water in Djibouti is between 10 and 20 million m3/year. The rational exploitation of groundwater resources must consider the nature of the soil, which is volcanic, sedimentary or alluvial.

Unconventional resources are limited to treated wastewater. The contribution of treated wastewater effluent is currently limited to the Balbala treatment plant, the output of which is estimated at 0.14 million m3/year and used to irrigate some gardens in the region of Ambouli. Another treatment plant, in Douda, with an installed capacity of 4,700 m3/day, is currently out of service.

Water is extremely scarce in Djibouti, with conditions set to be exacerbated by population growth and climate change. Djibouti averages 150mm of rainfall per year and has no perennial surface fresh water flow. Due to the climate, less than five percent of total rainfall reaches the water table, with the remainder lost to either evapotranspiration or flow to the sea due to flash floods. The country's total annual water use is around 19 million m3, including 2.5 million m3 for irrigation (13 per cent) and 0.5 million m3 for livestock (3 per cent), with the remaining 84 per cent for household and municipal uses. It is estimated that 20 per cent of the population has no access to potable water and that more than 70 per cent of the rural population (and its herds) do not have access to water within a reasonable distance. About 95 per cent of total water use comes from groundwater aquifers, which are primarily recharged from rainwater runoff infiltration in seasonal streams (wadis or oueds). The sustainable water recharge rate of these aquifers is estimated at 10-20 million m3 per year. However, due to demographic pressures, it is estimated that total water consumption will increase to about 29 million m3 by 2015, putting additional pressure on groundwater resources. Furthermore, climate change impacts are projected to exacerbate these already precarious water resource challenges. Temperatures are projected to increase by 1.7-2.1°C by 2050, while precipitation is set to decrease by 4-11 per cent. This could lead to increased severity of dry spells and increased intensity of wet extremes, thus accelerating floods and erosion. Sea-level rises are also expected to further exacerbate these impacts through saltwater intrusion into coastal aquifers (World Bank, 2011)

In Djibouti, there are no permanent rivers. Hydrographical networks are formed by intermittent-flow wadis. Groundwater comes mainly from the Ethiopian highlands (except for the sheet of Djibouti) and, to a smaller extent, local infiltration, especially for the recharge of shallow groundwater. These waters are springs or wells operated from the aquifers. Temporary lakes in depressions provide a significant water resource for nomadic communities (MAEM, 2000).

Runoff from wadis plays an important role in groundwater recharge and therefore represents an important resource. The river system can be divided into two systems: the system drained to the sea, and the network drained to the west plains (MAEM, 2000).

The drainage network to the sea consists of (MAEM, 2000):

•the plateaus south of Djibouti, drained by the wadis Ambouli, Douda, Weyn, Damerdjog, Deydey Weyn and Wahayyi;

•the mountainous areas north of the Gulf of Tadjourah, drained by the wadis Weimer, Bosal, Saday, Magali and Dariyo;

•the mountainous areas south of the Gulf of Tadjourah, drained by wadis Bêyya Ader and Danan/Bayya Dader.

The drainage network to the plains of the west is composed of (MAEM, 2000):

•the Anbabba plain (329km2 watershed);

•the Adwa plain (1,579km2);

•the Der-Ela plain (405km2);

•the Gaggadé plain (1,068km2);

•the Hanlé Plain (1,930km2);

•the Gobaad Plain (486km2);

•the Grand Bara (835km2).

Water withdrawals throughout the country are estimated at 13 million m3/year for the capital and less than 0.7 million m3/year for the four district towns (Ali Sabieh, Dikhil, Tadjourah and Obock) (MAEM, 2000).

Three main types of aquifers have been identified (MAEM, 2000):

•continuous aquifers: present in most western countries and Djibouti-Loyada, these are young volcanic rock aquifers (basalts series of the Afar stratabound). They are among the most productive;

•discontinuous aquifers: aquifers in ancient rocks (basalts Dalha, rhyolites of Mabla, secondary sedimentary formations);
•in the census of 1988, a large aquifer was identified in the rhyolites cracks of the Hanlé plain between 300m and 800m in depth (T: 48°C, salt content: 1.3g/L).
Groundwater is the most reliable resource in the country. It is easily accessible with simple and cheap technology, and is generally of suitable quality for irrigation (MAEM, 2000).
Groundwater recharge is by infiltration of stormwater (drainage basins) and infiltration of flood waters in river beds and alluvial terraces. It was estimated that the potential water resources of the shallow aquifers will ensure the development of a fifth (2,000 ha) of the country cultivation surface, estimated at 10,000 ha (MAEM, 2000).

1.1.2. WATER USE

It is estimated that water demands for 2000 were 19 million m3, of which 2.5 million m3 was for irrigation (13 per cent), 0.5 million m3 for livestock (3 per cent) and 16 million m3 for communities (84 per cent). Another figure of 7.41 million m3 for agriculture is also sometimes given, but this figure is probably overstated because, typically, only a third of the fenced area is currently irrigated. About 95 per cent of water needs are provided by groundwater resources. Population pressure is increasing, resulting in overuse and salinization. By 2015, demand may amount to more than 29 million m3.
In 2000, there were 600 water points (partially functional) and 56 pumping stations in rural areas throughout the country. Salinity due to over-exploitation is increasing and more than half of the drilling in Djibouti recorded levels of more than 900mg/L, and sometimes of up to 1,200mg/L.
In general, the use of groundwater for irrigation is limited by problems of excessive salinity, even in the alluvial groundwater. Only waters in the northwest of the country have ionic concentrations below the standards necessary for irrigation. High levels of boron are common. Few locations are favourable for irrigation projects from drilling. However, it is possible to use water from the sub-flows in the wadis where watersheds are large and floods are regular.
The under-development and poor economic performance of the agriculture sector is a direct consequence of the country's inherent aridity and its fragile water and soil resource base, which constrain local production. It also results, in part, from low levels of investment in modern farming practices, especially in the area of water resource management (rainwater harvesting, construction of boreholes, recharge of aquifer, etc.), which is necessary in order to increase sectoral outputs and productivity in a sustainable and effective manner. Given the predominance of the urban population, the government of Djibouti has favoured until now the development of the service sector, with the objective of positioning Djibouti as a strategic transit hub that can offer commercial access to the sea for neighbouring landlocked countries. As a result, few investments have been made in agriculture and rural development and productivity levels have been stagnant or even in decline, especially during recent dry years. However, because of high poverty rates and limited cash income opportunities in rural areas, agricultural activities do continue to play a critical role in the food supply and daily subsistence of the rural communities involved in production (AFB, 2011).
Nomadic pastoral and farming systems, including agro-pastoralism, have reached their production limit, largely due to increasing water stress and land degradation. Being mostly a volcanic arid landscape, Djibouti is highly susceptible to desertification and pastoral communities relying on natural rangelands have been increasingly affected by a mounting trend of aridity and desertification. The more frequent and longer droughts of the past decades have inflicted major blows on the quality, productivity and spatial distribution of natural pastures and water points, which are mainly shaped by rainfall and are critical for livestock survival during the dry season (AFB, 2011).
At the same time, government policies constraining herd mobility and encouraging sedentarization have been introduced on the assumption that it is impossible, or anyway too expensive, to deliver satisfactory development services (e.g. health and education) to mobile pastoralists. In response to these drivers, many nomadic communities have settled in the last few decades, if not migrated to urban areas, concentrating mainly around relatively reliable water sources and imposing enormous pressures on the neighbouring land and limited water resources (AFB, 2011).

1.2. WATER QUALITY, ECOSYSTEMS AND HUMAN HEALTH

Overexploitation of renewable groundwater is estimated at 15 million m3 per year. The salinity of the water can reach 1.9g/L, making it unfit for consumption. The lack of adequate sanitation is a concern in Djibouti City. There are signs of salinization of land, which may lead to sterility.
According to the 2004 Djibouti Poverty Reduction Strategy Paper (PRSP), foreign nationals represent 15 per cent of the total population. The population continues to be plagued by a high and rising incidence of tuberculosis, malaria, cholera and AIDS (WHO, 2004).
Tuberculosis (TB), the ailment most typically associated with poverty, overcrowding and poor hygiene, has a long history in Djibouti. With 588 cases of TB per 100,000 inhabitants, Djibouti has the second-highest rate of TB incidence in the world, after Swaziland. However, about 40 per cent of the cases come from neighbouring countries, in particular from Ethiopia, which inflates the rate. Foreigners come to Djibouti because it offers more and better-quality services. Over the last ten years, Djibouti has recorded an average of about 3,572 new cases of tuberculosis per year, peaking in 2000 with 4,121 diagnosed cases. As with other countries, the link between HIV and TB is apparent. Although the sero-prevalence rate in the general population is less than 3 per cent, it was 26.1 per cent among TB patients in 2001, up from 13.1 per cent in 1999. Even though the national programme remains one of the best in the region, with a 72 per cent therapeutic success rate (treatment completed and patients cured) in 2000, a serious lack of personnel and the loss of financial assistance from France Cooperation in June 2002 made it difficult to maintain previous performance levels.
Malaria has only been a problem in Djibouti since the late 1980s. Before 1973, when there was no urbanization, no irrigation and an active attempt to control the vector during the rainy season, more than 80 per cent of the notified cases were from people entering Djibouti from neighbouring countries. From 1973 to 1987, more Djibouti nationals' cases appeared along the main transport

lines linking Djibouti to neighbouring countries and, after 1987, cases manifested in the urban areas as thousands of refugees resettled in Djibouti. Since 1988, the spread of malaria has increased steadily. Uncontrolled urbanization with insufficient water supplies, non-existent wastewater evacuation systems, the settlement of nomad population in rural areas, increased irrigated areas and frequent floods have contributed to the endemic. Djibouti currently records over 4,000 confirmed cases of malaria each year (WHO, 2004).

In 1997, according to a report by the Ministry of Health (MOH), diarrhoeal illnesses (e.g. cholera, typhoid fever, amoebic dysentery, viral hepatitis, etc.) accounted overall for 11 per cent of medical consultations; for children under the age of five, the figure was 16.5 per cent. In addition, the MOH's 1996 report indicates that diarrhoeal illnesses are the second most frequent cause of in-hospital mortality, accounting for 12 per cent of such deaths. The same report identifies diarrhoeal illnesses as the second most frequent cause of death for children between the ages of one and four years. Poor water quality affecting mainly the rural and poorer segments of the population is a contributing factor in these cases (WHO, 2004).

Since 1989, Djibouti has experienced four cholera epidemics, the last three of which affected nearly the entire country, although the majority of cases were in the city of Djibouti. Care of those stricken with cholera has gradually improved: while the epidemic of 1989 killed 8 per cent of its victims, the mortality rate was 2 per cent for the epidemics of 1993 and 1997, and even higher for the most recent epidemic in 2000. During the 1997 cholera epidemic, increased epidemiological surveillance of diarrhoeal illnesses revealed that dysentery accounted for about 10 per cent of the cases of diarrhoea recorded during the outbreak (WHO, 2004).

2. GOVERNANCE ASPECTS

2.1. WATER INSTITUTIONS

The Ministry of Agriculture, Livestock and Marine is in charge of water resources and responsible for the implementation of water policy and rural development. Its mandate and responsibilities include interventions in the following areas: animal production, crop production and improvement of the vegetation, veterinary and food control, study and exploitation of water resources, fisheries production, and marine issues. National Water Djibouti (ONED), which manages the waterworks supplying the main urban areas, is under its guardianship. The Department was reorganized by the Act of 1 October, 2001 and there is now a Directorate of Water (water services, engineering and work and support for the decentralized management of water) and a Department of Agriculture, Livestock and Veterinary Services.

In 1989, the government created the National Council of Water Resources (CNRE), chaired by the Minister of the MAEM and entrusted with the task of coordinating and planning all actions concerning water. The CNRE pays particular attention to the exploitation of scarce surface water, with the objective of ensuring recharge and diversifying water supplies for rural people. The future integrated management of the Oued Ambouli will address this concern. The use of underground dams on the main layers of the infero-feed will be tested at pilot sites.

The National Fund for Water (FNE), created by decree on November 4, 2001, provides funding for the maintenance of pumping stations, a rural network of food relief, and the creation urban standpipes.

The Centre for Study and Research of Djibouti (CERD) is responsible for the scientific control of the quality of drinking water and for the identification of new sites.

2.2. WATER MANAGEMENT

According to JMP figures, Djibouti is close to reaching the MDGs for the urban water sector. It is estimated that, by 2015, of Djibouti's estimated 686,300 urban population, only 60,000 will lack adequate access to water and 96,000 to adequate sanitation. Nevertheless, only 50 per cent of Djibouti's urban population is connected to the public water supply. The other 50 per cent draws water from connected neighbours or from public standpipes.

In rural areas, reported coverage rates for water are decreasing, despite the population's negative growth rate, because of the reduction in available water resources. Regarding rural sanitation, an additional 60,000 persons are expected to get access to safe sanitation by 2015.

The main challenge for Djibouti is its increasingly scarce water resources, combined with urban population growth. The country's situation is particularly worrying as sustainable water resources are estimated at only 50m3 per capita per year, compared with an average of 1,000m3 per capita per year for the water-stressed Middle East and North Africa region. Almost all of Djibouti's water supply is sourced from underground wells, and most of these wells are old and close to exhaustion.

In summary, this suggests that Djibouti will reach the MDGs for water and sanitation in urban areas, but will be unlikely to meet the target for rural water and sanitation. A specific MDG action plan for rural water and sanitation needs to be developed. The institutional arrangements and performance of the Djibouti National Water and Sanitation Office (ONEAD) need to be strengthened, and dedicated sector investment increased. To achieve this, the government of Djibouti could: (a) improve planning and monitoring of activities; (b) anticipate procurement procedures to secure new water resources; (c) improve ONEAD's financial and technical performance; and (d) mobilize resources to improve rural sanitation (UNDP-WGP, 2010).

There are two main constraints on the water sector: natural constraints related to water sources, and institutional constraints (such as technical and financial management).

The country's arid climate makes drinking water supply particularly difficult (AFDB, 2007). More than 95 per cent of the drinking water comes from groundwater, which is very salty and often extremely hot. Moreover, drinking water needs in Djibouti City are growing considerably due to a sharp increase in new group housing complexes and the expansion of economic activities in the port area.

The main institutional constraints concern management, notably billing (deficiencies in metering), a low tariff collection rate (the amount of outstanding bills has increased, especially in government services), and high technical losses due to ageing equipment and illicit tapping of the distribution network. However, the national water and sanitation authority set up in February 2006, which is a grouping of all water and sanitation services, has embarked on the rationalization of water management in keeping with the pace and needs of development (AFDB, 2007).

2.3. WATER POLICY AND LEGAL FRAMEWORK

All agricultural land is owned by the state, although customary law, which guarantees the ownership of anyone who works the land, is respected.

The Water Code was created by the Act of April 4, 1996 and in February 2000 a Master Plan for Water (SDE) was adopted. Institutional measures include the creation of the Directorate of Water and sub-regional offices and a national fund for water. Among the infrastructure measures approved are the establishment of a national inventory of water resources and water points, a programme of hydrogeological prospecting to identify new resources, increased mobilization of water, and solarization of water points in rural areas.

Moreover, a law on decentralization, stipulated in July 2002, aims to develop secondary centres of the country to reduce human pressure on the natural environment. Five regional councils have been established: Ali-Sabieh, Arta, Dikhil, Obock and Tadjoura. The objective set by the UNDP for 2007 was to decentralize 20 per cent of the national drinking-water budget and to prospect for new sites.

Drinking water supply has always been a dominant concern for the government of Djibouti. Indeed, since the country's independence in 1977, policy-makers have focused on the improvement of drinking water supply. During the first phase of policy, global national documents integrating water resources and specific action plans dealing with drinking water supply were drawn up. In 2000, which marked the start of the second phase of water supply actions, a national strategic framework took shape and specified actions for sustainable water management. This strategy was based on four key objectives: promoting the rational management of water resources, subject to the necessity of protecting these resources and of meeting the current and future needs of the populations and the economy; improving the availability and quality of water throughout the country and bringing it within the reach of the poor; strengthening the institutional framework of water management and enhancing the performance of the administrations in charge of the sector; involving local authorities and populations in the choice of programmes and in water management (WGP-AS, 2009).

The various action plans implemented by Djibouti are as follows (WGP-AS, 2009):

•the 1988 water emergency plan. Given the critical situation of drinking water supply, as well as the effects of chronic drought, the Ministry of Agriculture launched a water emergency plan in collaboration with the CERD and the ONEAD. To begin with, the needs of the country's different districts were identified based on consultations with local and government officials. In view of the funding available from international and bilateral donors, a priority action programme was established and the works' costs and timescales were evaluated. This emergency programme included complementary actions designed to meet the needs of the urban and rural populations. As such, it extended over a three-year period;

•planning of urban centres' water resources (Lavalin-Tractebel, 1993). The ONEAD, in charge of supplying the urban centres of Djibouti (Djibouti, Ali-Sabieh, Arta/Oueah, Dikhil, Tadjourah and Obock) with drinking water, prepared for AEP planning. Its study relied on available demographic data, on the socio-economic context and on information regarding ONEAD clients. The needs of the various towns were thus assessed and solutions outlined, among which were the extension of existing well fields and the possibility of exploiting new fields if water resources proved to be insufficient;

•the 1994 AEP action plan for the city of Djibouti. Given the problems linked to Djibouti's aquifer, the sustained degradation of the pumped water quality, and the necessity of meeting the city's growing water needs, an action plan was prepared, which covered, among other things, the performance of new water drillings and hydrogeologic studies for the management of the volcanic aquifer.

3. GEOPOLITICAL ASPECTS

Djibouti is one of the smallest countries in Africa, with 372km of coastline and a total area of 23,200km2, of which 100km2 is surface water (lakes and Abhé Assal) and 220 km2 forest. The salt Lake Abbe is the only international water resource.

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