

## Basin Risk Indicators - Descriptions, Sources and Links

Risk type	Risk category	#	Risk indicator	Description	Source	Link
Physical Risk	1. Water Scarcity	1.0	Aridity Index	<a href="#">See Global Documentation on Indicators, Sources and Description</a>		
		1.1	Water Depletion	<a href="#">See Global Documentation on Indicators, Sources and Description</a>		
		1.2	Soil Moisture	This risk indicator is based on the variable called Aridity 1, which measures the ratio of potential evapotranspiration (i.e. modelled value when there is abundant water) to precipitation, based on the reference period 1971-2000. The results are expressed as percentage of relative change to the reference period.	Hundecha, Y., Arheimer, B., Donnelly, C., & Pechlivanidis, I. (2016). A regional parameter estimation scheme for a pan-European multi-basin model. <i>Journal of Hydrology: Regional Studies</i> , 6, 90–111. <a href="https://doi.org/10.1016/j.ejrh.2016.04.002">https://doi.org/10.1016/j.ejrh.2016.04.002</a> .	<a href="https://cds.climate.copernicus.eu/cdsapp#!/dataset/sis-water-quantity-swicca?tab:overview">https://cds.climate.copernicus.eu/cdsapp#!/dataset/sis-water-quantity-swicca?tab:overview</a>
		1.3	Water deficit	This risk indicator is based on the variable called Aridity 2, which measures the ratio of actual evapotranspiration (i.e. evapotranspiration computed only with available water) to precipitation, based on the reference period 1971-2000. The results are expressed as percentage of relative change to the reference period.	Hundecha, Y., Arheimer, B., Donnelly, C., & Pechlivanidis, I. (2016). A regional parameter estimation scheme for a pan-European multi-basin model. <i>Journal of Hydrology: Regional Studies</i> , 6, 90–111. <a href="https://doi.org/10.1016/j.ejrh.2016.04.002">https://doi.org/10.1016/j.ejrh.2016.04.002</a> .	<a href="https://cds.climate.copernicus.eu/cdsapp#!/dataset/sis-water-quantity-swicca?tab:overview">https://cds.climate.copernicus.eu/cdsapp#!/dataset/sis-water-quantity-swicca?tab:overview</a>
		1.4	Water Exploitation Index Plus (WEI+)	The water exploitation index plus (WEI+) indicator measures the percentage use of the total renewable freshwater resources available in a river basin for the reference period 1990-2017.	European Environment Agency (2019). Seasonal water exploitation index plus (WEI+), sub river basin district scale [Dataset].	<a href="https://www.eea.europa.eu/data-and-maps/figures/seasonal-water-exploitation-index-plus-1">https://www.eea.europa.eu/data-and-maps/figures/seasonal-water-exploitation-index-plus-1</a>
		1.5	Drought Frequency Probability	<a href="#">See Global Documentation on Indicators, Sources and Description</a>		

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		1.6	Projected Change in Drought Occurrence	This risk indicator measures the projected change in meteorological drought frequency between the present (1981-2010) and the mid 21st century (2041-2070) in Europe, under RCP4.5 emissions scenario. Results represent the change in the number of events per 10 years.	European Commission - Joint Research Centre (2017). Science for disaster risk management 2017: Knowing better and losing less. Publications Office. <a href="https://data.europa.eu/doi/10.2788/842809">https://data.europa.eu/doi/10.2788/842809</a>	<a href="https://www.eea.europa.eu/data-and-maps/figures/projected-change-in-meteorological-drought">https://www.eea.europa.eu/data-and-maps/figures/projected-change-in-meteorological-drought</a>
	<b>2. Flooding</b>	2.1	Estimated Flood Occurrence	This risk indicator is based on a flood hazard map of 50-year events, and considers both the extent (percentage of the area) and average depth of flood-prone areas within river basins.	Dottori, Francesco; Alfieri, Lorenzo; Bianchi, Alessandra; Skoien, Jon; Salamon, Peter (2016): River flood hazard map for Europe and the Mediterranean Basin region - 50-year return period. European Commission - Joint Research Centre [Dataset]	<a href="http://data.europa.eu/89h/jrc-floods-floodmapeu_rp50y.tif">http://data.europa.eu/89h/jrc-floods-floodmapeu_rp50y.tif</a>
		2.2	Projected Change in Flood Occurrence	This risk indicator measures the projected change of a 100-year discharge. Results are expressed in percentage change between the reference period (1981-2010) and when the average global temperature reaches 2°C warming (around the year 2050, based on RCPs 4.5).	Mentaschi, L., Alfieri, L., Dottori, F., Cammalleri, C., Bisselink, B., Roo, A. D., & Feyen, L. (2020). Independence of Future Changes of River Runoff in Europe from the Pathway to Global Warming. <i>Climate</i> , 8(2), 22.	<a href="https://doi.org/10.3390/cli8020022">https://doi.org/10.3390/cli8020022</a>
	<b>3. Water Quality</b>	3.1	Ecological Status of Surface Water Bodies	This risk indicator is based on the WISE Water Framework Directive Database using the Ecological status of rivers, lakes, and transitional and coastal waters based on the sub-indicators 3.1.1 (Biological quality elements), 3.1.2 (Hydromorphological quality elements), and 3.1.3 (Chemical and physicochemical quality elements).	European Environment Agency (2020). WISE Water Framework Directive Database. Reference Spatial Datasets reported under Water Framework Directive 2016 - PUBLIC VERSION - version 1.4, Apr. 2020 [Dataset].	<a href="https://www.eea.europa.eu/data-and-maps/data/wise-wfd-4">https://www.eea.europa.eu/data-and-maps/data/wise-wfd-4</a>
		3.1.1	Biological Quality Elements	The sub-indicator biological quality elements measure the status (i.e. from high to bad status) of phytoplankton, macrophytes, phytobenthos, benthic invertebrate fauna and fish on water bodies.	European Environment Agency (2020). WISE Water Framework Directive Database. Reference Spatial Datasets reported under Water Framework Directive 2016 - PUBLIC VERSION - version 1.4, Apr. 2020 [Dataset].	<a href="https://www.eea.europa.eu/data-and-maps/explore-interactive-framework-directive-quality-elements">https://www.eea.europa.eu/data-and-maps/explore-interactive-framework-directive-quality-elements</a>
		3.1.2	Hydromorphological Quality Elements	The sub-indicator hydromorphological quality elements measure the status (i.e. from high to bad status) of hydrological or tidal regime; River continuity conditions, and Morphological conditions on water bodies.	European Environment Agency (2020). WISE Water Framework Directive Database. Reference Spatial Datasets reported under Water Framework Directive 2016 - PUBLIC	<a href="https://www.eea.europa.eu/data-and-maps/explore-interactive-framework-">https://www.eea.europa.eu/data-and-maps/explore-interactive-framework-</a>

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		3.1.3	Chemical and Physicochemical Quality Elements	The sub-indicator chemical and physicochemical quality elements measure the status (i.e. from high to bad status) of nutrients, oxygen condition, temperature, transparency, salinity and river basin specific pollutants – RBSPs on water bodies.	VERSION - version 1.4, Apr. 2020 [Dataset]. European Environment Agency (2020). WISE Water Framework Directive Database. Reference Spatial Datasets reported under Water Framework Directive 2016 - PUBLIC VERSION - version 1.4, Apr. 2020 [Dataset].	<a href="https://www.eea.europa.eu/data-and-maps/explore-interactive-maps/water-framework-directive-quality-elements">directive-quality-elements</a> <a href="https://www.eea.europa.eu/data-and-maps/explore-interactive-maps/water-framework-directive-quality-elements">https://www.eea.europa.eu/data-and-maps/explore-interactive-maps/water-framework-directive-quality-elements</a>
	4. Ecosystem Services Status	4.1	Fragmentation Status of Rivers	This risk indicator is based on empirical and modelled barrier densities per km of river, and estimates the barrier density (No./km) across Europe based on ground-truthed barrier number. A 'barrier' is defined as "any built structure that interrupts or modifies the flow of water, the transport of sediments, or the movement of organisms and can cause longitudinal discontinuity".	AMBER Consortium (2020). The AMBER Barrier Atlas. A Pan-European database of artificial instream barriers. Version 1.0 June 29th 2020 [Dataset].	<a href="https://amber.international/european-barrier-atlas/">https://amber.international/european-barrier-atlas/</a>
		4.2	Catchment Ecosystem Services Degradation Level	<a href="#">See Global Documentation on Indicators, Sources and Description</a>		
		4.3	Projected Impacts on Freshwater Biodiversity	<a href="#">See Global Documentation on Indicators, Sources and Description</a>		
Regulatory Risk	5. Enabling Environment	5.1	Freshwater Policy Status (SDG 6.5.1)	<a href="#">See Global Documentation on Indicators, Sources and Description</a>		
		5.2	Freshwater Law Status (SDG 6.5.1)	<a href="#">See Global Documentation on Indicators, Sources and Description</a>		
		5.3	Water Framework Directive Implementation Status	This risk indicator is based on the Water Framework Directive (WFD) and floods directive implementation report, which evaluates the recommendations on the River Basin Management Plans by country. The recommendation depicts the conditions that help to support the implementation of Integrated Water Resource Management (IWRM), which includes legal and strategic planning tools for IWRM.	European Commission (2019). Annex to the Report from the Commission to the European Parliament and to the Council on the implementation of the Water Framework Directive (200/60/EC) and Floods Directive (2007/60/EC) Second River Basin Management Plans, First FloodRisk Management Plans.	<a href="https://eur-lex.europa.eu/resolve.html?uri=cellar:bee2c9d9-39d2-11e9-8d04-01aa75ed71a1.0005.02/DOC_2&amp;format=PDF">https://eur-lex.europa.eu/resolve.html?uri=cellar:bee2c9d9-39d2-11e9-8d04-01aa75ed71a1.0005.02/DOC_2&amp;format=PDF</a>

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	6. Institutions & Governance	6.1	Corruption Perceptions Index	<a href="#">See Global Documentation on Indicators, Sources and Description</a>		
		6.2	Derogations of Water Framework Directive objectives	This risk indicator is based on the WISE Water Framework Directive Database and measures how members states use exemptions or derogations not to meet the WFD objectives, in the form of extended deadlines or the setting of less stringent objectives. It considers 1) whether WFD targets were met, 2) whether targets were weakened, and 3) if target deadlines were extended.	European Environment Agency (2020). WISE Water Framework Directive Database. Reference Spatial Datasets reported under Water Framework Directive 2016 - PUBLIC VERSION - version 1.4, Apr. 2020 [Dataset].	<a href="https://www.eea.europa.eu/data-and-maps/data/wise-wfd-4">https://www.eea.europa.eu/data-and-maps/data/wise-wfd-4</a>
		6.3	Private Sector Participation in Water Management (SDG 6.5.1)	<a href="#">See Global Documentation on Indicators, Sources and Description</a>		
7. Management Instruments		7.1	Management Instruments for Water Management (SDG 6.5.1)	<a href="#">See Global Documentation on Indicators, Sources and Description</a>		
		7.2	Groundwater Monitoring Data Availability and Management	This risk indicator measures the density of groundwater monitoring sites. It is determined according to the groundwater monitoring sites reported to the European Commission under the Water Framework Directive (WFD) reporting obligations for European river basin districts, the river basin district sub-units, the surface water bodies and the groundwater bodies delineated for the 2nd River Basin Management Plans (RBMP) due in 2016.	European Environment Agency (2019). Waterbase - Water Quality [Dataset]	<a href="https://www.eea.europa.eu/data-and-maps/data/waterbase-water-quality-2">https://www.eea.europa.eu/data-and-maps/data/waterbase-water-quality-2</a>
		7.3	Density of Runoff Monitoring Stations	This risk indicator measures the density of runoff monitoring stations. It is determined according to the river monitoring sites reported to the European Commission under the Water Framework Directive (WFD) reporting obligations for European river basin districts, the river basin district sub-units, the surface water bodies and the groundwater bodies delineated for the 2nd River Basin Management Plans (RBMP) due in 2016.	European Environment Agency (2019). Waterbase - Water Quality [Dataset]	<a href="https://www.eea.europa.eu/data-and-maps/data/waterbase-water-quality-2">https://www.eea.europa.eu/data-and-maps/data/waterbase-water-quality-2</a>
8. Infrastructure & Finance		8.1	Access to Safe Drinking Water	<a href="#">See Global Documentation on Indicators, Sources and Description</a>		
		8.2	Access to Sanitation	<a href="#">See Global Documentation on Indicators, Sources and Description</a>		
		8.3	Flood Protection Levels	This risk indicator measures the estimated flood protection level for each region in the entire EFAS domain as a proxy for infrastructure and finance availability. It estimates flood events above the protection level that will cause flooding by measuring the return period of the maximum flood event, which can be beard by the defence measures (e.g. dikes).	European Commission - Joint Research Centre (2020). Adapting to rising river flood risk in the EU under climate change: JRC PESETA IV project : Task 5. Publications Office. <a href="https://data.europa.eu/doi/10.2760/14505">https://data.europa.eu/doi/10.2760/14505</a>	<a href="https://www.efas.eu/efas_frontend/#/home">https://www.efas.eu/efas_frontend/#/home</a>

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Reputational Risk	9. Cultural Importance	9.1	Cultural Diversity	<a href="#">See Global Documentation on Indicators, Sources and Description</a>		
	10. Biodiversity Importance	10.1	Freshwater endemism	This risk indicator is based on the European Red List of Freshwater Fishes produced by the IUCN BioFresh project, which measures status, trends, pressures and conservation priorities of freshwater biodiversity and its related ecosystem services. The rationale is that companies operating in river basins with higher number of endemic fish species are exposed to higher reputational risks.	Freyhof, J., & Brooks, E. (2011). European red list of freshwater fishes. European Commission. Directorate-General for the Environment. Publications Office. <a href="https://data.europa.eu/doi/10.2779/85903">https://data.europa.eu/doi/10.2779/85903</a>	<a href="https://www.iucnredlist.org/resources/spatial-data-download">https://www.iucnredlist.org/resources/spatial-data-download</a>
		10.2	Freshwater biodiversity richness	This risk indicator measures the number of extant fish species per hydrobasin. It is based on the IUCN BioFresh project, which measures status, trends, pressures, and conservation priorities of freshwater biodiversity and its related ecosystem services. The rationale is that companies operating in river basins with higher number of fish species are exposed to higher reputational risks.	Freyhof, J., & Brooks, E. (2011). European red list of freshwater fishes. European Commission. Directorate-General for the Environment. Publications Office. <a href="https://data.europa.eu/doi/10.2779/85903">https://data.europa.eu/doi/10.2779/85903</a>	<a href="https://www.iucnredlist.org/resources/spatial-data-download">https://www.iucnredlist.org/resources/spatial-data-download</a>
	11. Media Scrutiny	11.1	National Media Coverage	<a href="#">See Global Documentation on Indicators, Sources and Description</a>		
11.2		Global Media Coverage	<a href="#">See Global Documentation on Indicators, Sources and Description</a>			
12. Conflict	12.1	Conflict News Events	<a href="#">See Global Documentation on Indicators, Sources and Description</a>			
	12.2	Hydro-political Likelihood	<a href="#">See Global Documentation on Indicators, Sources and Description</a>			