MSCI Institute

Beyond Scarcity:

The Dual Dimensions of Water Risk in Global Portfolios

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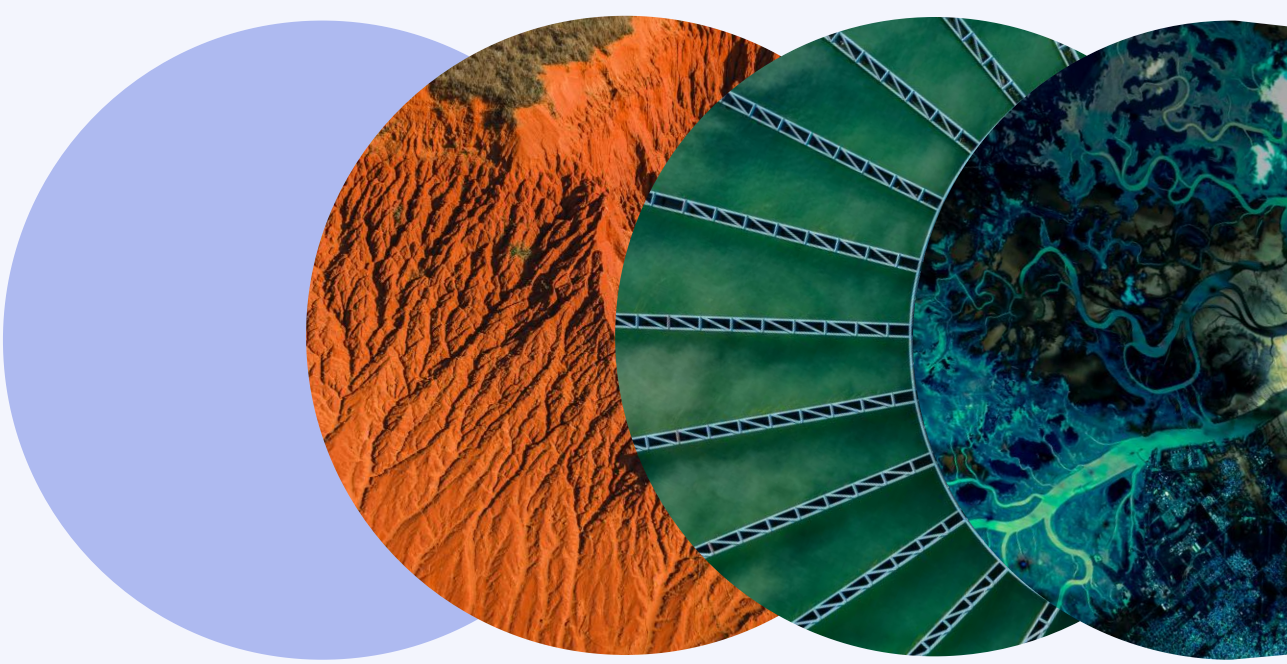


Contents

Highlights

Two dimensions of water risk

Water risk has two distinct dimensions – availability and quality – driven by different factors and not necessarily coinciding geographically. Assessing exposure requires examining both.

Availability alone can mislead

Availability metrics can produce a misleading view of exposure, particularly for companies in sectors that require water meeting specific quality standards. Of the more than one million facilities belonging to listed companies globally, roughly 12% face significant water-quality risk but not water-availability risk. These facilities support operations or activities that depend on water quality, with food and beverage production and hospitality services accounting for most (92%) of this subset.

Industry exposure varies widely

Companies in the household products and hotel & resort REITs industries face the greatest combined exposure. The hotel & resort REITs industry shows the starkest quality-only profile – roughly a quarter (25%) of companies in the industry face low risk on availability but high risk on quality. Utilities and power producers are predominantly exposed to availability risk, reflecting their reliance on consistent water volumes for cooling.

Geography shapes exposure

Similar risk profiles can have sharply different drivers. In California, water-quality risk can stem from wildfire contamination; in northern India, it can reflect groundwater over-extraction and arsenic contamination.

Introduction

The availability and quality of water are growing in relevance for companies and investors globally.

Water is essential to nearly every sector of the modern economy – from agriculture and energy production to tourism, semiconductors and the data centers powering artificial intelligence. Yet as much as water risk matters to companies, investors may only be seeing half of it.

Assessing water risk is not new to investors. Both the UN Principles for Responsible Investment (PRI) and CDP urge investors to integrate water-related data and tools into equity analysis.[1] While most current frameworks now recognize both the availability and quality of water as distinct dimensions of water risk, quality risks and their operational impacts are not yet fully reflected in practice.[2]

Water quality extends beyond scarcity to capture the condition or ecological health of water resources, as indicated by measures such as nutrient concentration, eutrophication (excessive algae from over-enrichment by fertilizers or sewage), and pollution from chemicals and plastic. Below, we examine the availability and quality risk exposure of water across the facilities (e.g., factories, mines and plants) operated by listed companies globally.[3]

The two dimensions of water risk

Availability and quality are distinct dimensions of water risk, shaped by underlying drivers. Availability is predominantly influenced by local climatic conditions and associated precipitation patterns.

Quality can be shaped by local management of water and national or subnational regulation. Both availability and quality are also shaped by population density. Where more people live and work, there is greater demand on local water supplies, and more potential for domestic, industrial and agricultural waste entering the same systems, degrading their quality.

For example, a beverage factory in a monsoon-dependent region may face seasonal fluctuations in water supply. By contrast, a brewery located in an area with abundant water supply but weak regulation of industrial discharge may not face shortages but could find its water intake contaminated with chemical waste from nearby factories, leading to higher production costs due to additional treatment.

These distinct drivers mean the two risks do not necessarily coincide geographically, and that exposure to one does not always indicate exposure to the other. A company's risk profile depends on both the location of its facilities and their function, as industries vary in their sensitivity to water use. This variation extends to the facility level: Some facilities, such as nuclear power plants, require abundant water regardless of its quality, while others, such as semiconductor fabrication plants, may be sensitive to both. A complete picture of water risk therefore requires frameworks that capture both dimensions.

We estimate that around 12% of facilities (approximately 115,000 facilities) operated by listed companies globally are exposed to poor water quality without facing water scarcity. These facilities are the focus of this analysis, highlighting the need to assess water risk across both availability and quality dimensions.

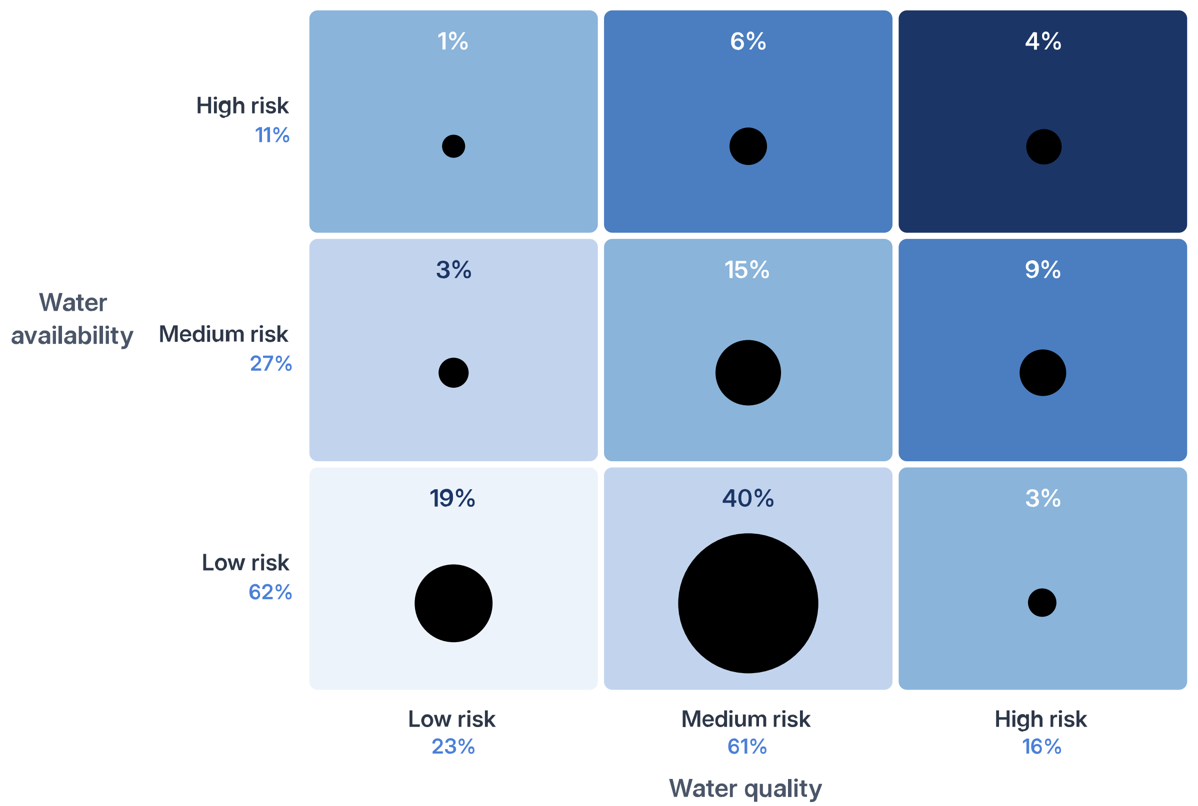
Our analysis draws on more than one million corporate facilities, as captured in the MSCI GeoSpatial Asset Intelligence database as of January 2026. We assess exposure to water-related risks using indicators from the World Wide Fund's Biodiversity Risk Filter (WWF BRF), integrated into MSCI GeoSpatial Asset Intelligence, to capture both water availability and quality.[4] For each dimension, the WWF BRF combines a facility's local state of nature (e.g., water quality levels) with its operational dependency to measure exposure on a scale from 1 (very low risk) to 5 (very high risk) (Appendix 2).

These risks do not always coincide. Of the total facilities operated by listed companies globally, 62% face low risk related to water availability (Exhibit 1). This partly reflects the nature of their operations: many are offices or general retail locations, with little dependence on water, so their risk is low regardless of local supply conditions.[5] Water quality shows a different pattern, with 61% of facilities facing medium risk. This reflects a high share of operations such as food and beverage production, which require water meeting strict quality standards regardless of physical scarcity.[6]

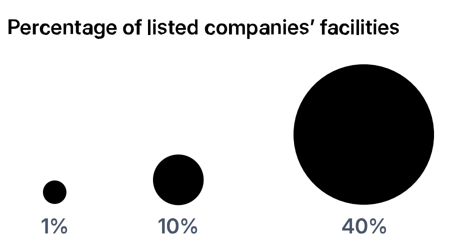
Exhibit 1 shows an asymmetry between the two dimensions: more facilities face high water-quality risk without high water-availability risk (12%) than the reverse (7%). This implies that an availability-only lens would leave a larger blind spot than a quality-only lens, with facilities exposed to quality risk alone more likely to be overlooked.

These 115,000 facilities (12%) support operations that depend on water quality, with food and beverage production and hospitality services accounting for most (92%) of the total. Hotels and restaurants require reliable access to safe, clean water, while beverage-production facilities (such as breweries and bottlers) depend on potable water for both quality and volume, regardless of local water availability.

Exhibit 1. Two dimensions of water risk to companies' facilities



Percentage of listed companies' facilities



Total assets: 1,020,916
Total companies: 8,196

Low risk	Med risk	High risk
<=2.6	2.7–3.4	>3.4

Source: MSCI Biodiversity Risk Metrics, data as of March 2026. Thresholds for high, medium and low risk are based on the WWF Biodiversity Risk Filter Methodology Documentation (2024). Facilities with an operation or activity of 'Other' were excluded as their inclusion would reduce the interpretability of the risk distributions by introducing facilities whose water dependency cannot be determined.

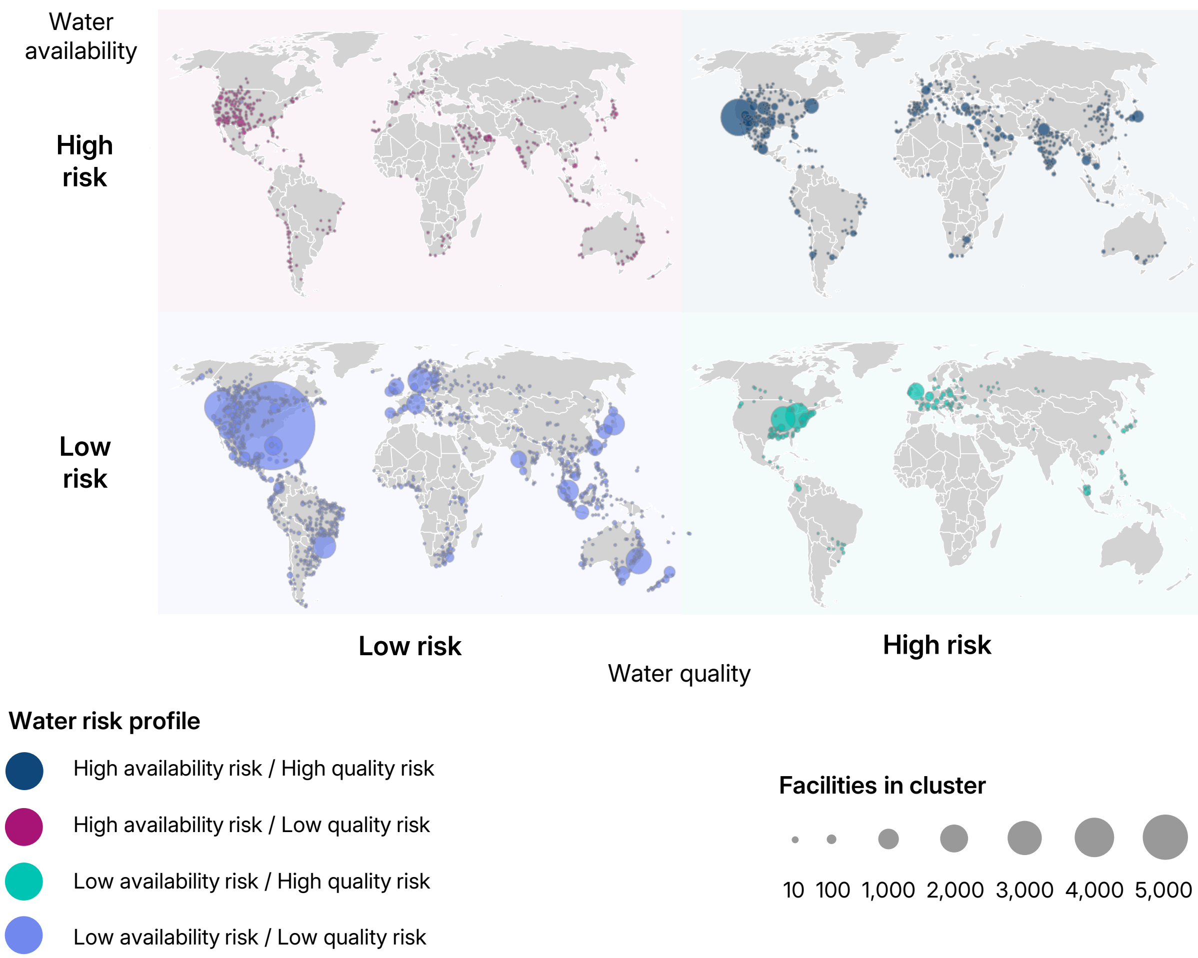
Geographic distribution of exposure

Water-related risks exhibit strong spatial variation, with distinct risk profiles concentrated in specific regions.

These patterns are most visible at the facility level; aggregation at the portfolio level can obscure important location- and industry-specific signals. Understanding geographic concentration is critical for effective risk management and the design of targeted mitigation measures – but only if both dimensions of water risk are considered from the outset.

Water-availability and water-quality risks often compound in densely populated regions with limited rainfall and higher temperatures, particularly outside temperate climate zones. Facilities exposed to high water risk in one or both dimensions tend to be geographically concentrated, with notable clusters in Western Europe, Southern Japan and Texas (Exhibit 2).

Exhibit 2. Global distribution of corporate facilities by water-risk profile



Source: MSCI Biodiversity Risk Metrics, data as of March 2026. Facilities in each water risk combination were isolated, excluding facilities with the activity of "other." Facilities in each water risk combination were then spatially clustered using DBSCAN (Density-Based Spatial Clustering of Applications with Noise), a geographic clustering algorithm that groups facilities based on proximity without requiring a predefined number of clusters. Clusters were defined as a minimum of 3 facilities within a 50 km radius.

This pattern reflects the spatial distribution of underlying environmental and socio-economic factors. The drivers of risk, however, can differ significantly even across regions with similar profiles (Exhibit 3). California, for example, is primarily affected by precipitation variability and wildfires, while northern India faces groundwater overexploitation and naturally occurring arsenic contamination. In both regions water availability and quality risks are potentially high.

Exhibit 3. Regional drivers of water risk (water availability and quality)

	Low water-quality risk	High water-quality risk
High water-availability risk	**Gulf region** – extreme aridity; more control over water quality, owing to reliance on desalination[7] or the relative absence of freshwater sources to pollute. **Texas** – one of the fastest-growing population states in the U.S. with increasingly variable interannual rainfall;[8] active water quality monitoring programs.[9]	**California** – high interannual rainfall variability and drought whilst having high agricultural demand;[10] sediment, ash and metals from wildfires can contaminate water supplies.[11] **Florida** – heavy reliance on the Floridan aquifer and risk of overexploitation;[12] saltwater intrusion from rising sea levels threatens water quality.[13] **North India –** unsustainable depletion of Indo-Gangetic Basin groundwater; over-extraction of groundwater has triggered geological release of naturally occurring arsenic into aquifers.[14] **Northeast China** – high population growth and significance in grain production has created strong municipal and agricultural demand;[15] contamination from livestock manure discharge and fertilizer runoff.[16]
Low water-availability risk	Facilities with this risk exposure are globally widespread but are especially concentrated in: **Northern Europe** – more frequent rainfall and large river networks; active water quality monitoring programs.[17]	**Central Europe** – extensive water network and storage system; historical and current PFAS contamination from industrial sites,[18] high nitrate–nitrite concentration from agricultural fertilizer runoff and animal manure discharge. **Southern Japan** – relatively high rainfall and water supply;[19] prone to natural hazards such as earthquakes and tsunamis which can damage water infrastructure and carry pollutants into water sources.[20]

For some facility clusters, local water conditions alone do not fully explain the observed risk profile. Instead, risk is better explained by the interaction between facility-level activity and the regional water context – without considering both, quality risk can remain hidden where water appears plentiful. In Southern Japan, the concentration of hospitality facilities illustrates this precisely.

These facilities depend on water in both quantity and quality, requiring abundant supply for guests' consumption, food preparation and operations, while also demanding that it meets strict safety standards. Assessed on water availability alone, the region's relatively abundant supply suggests low risk.[21] Yet this masks the underlying quality risks driven by operational demands and further compounded by seismic damage to water infrastructure that can compromise supply quality.[22] These hospitality facilities are among the 115,000 that remain overlooked when only water availability is considered.

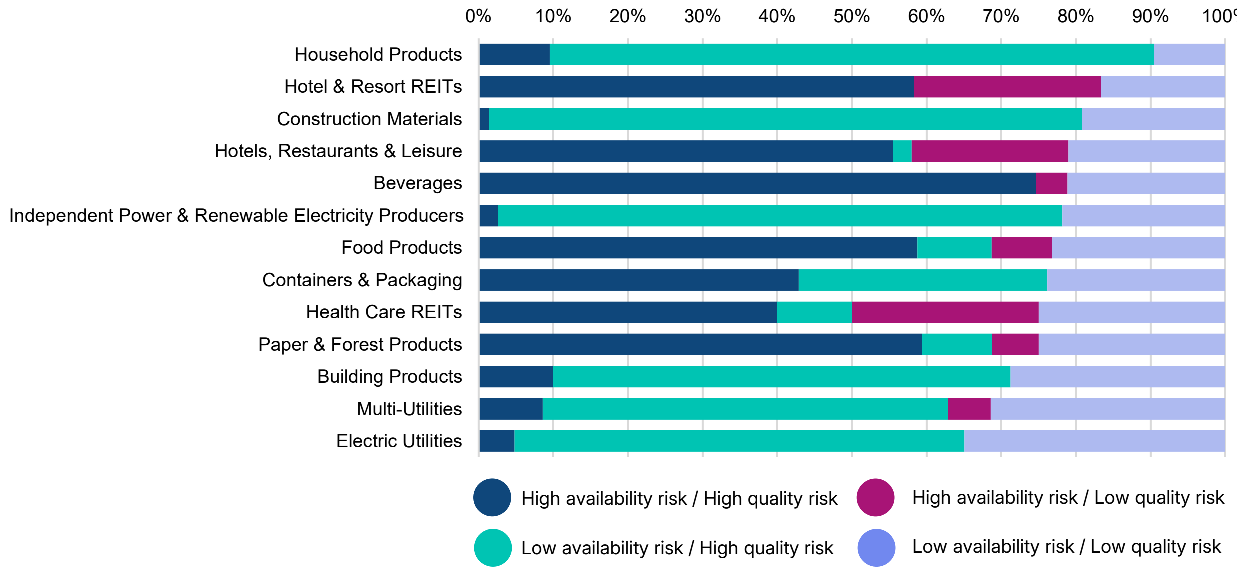
Industries most exposed to water risk

Risk profiles vary not only by location but also by industry. We use MSCI Biodiversity Risk Metrics to condense facility-level data on water-related risk indicators to the company level.[23]

Exhibit 4 shows the distribution of companies across the two risk dimensions for the most water-exposed GICS® industries.[24]

As the exhibit shows, conventional metrics focused on water availability capture the largest share of companies with meaningful water exposure (navy and teal categories). These include beverages, food products and paper and forest products – industries reliant on water-intensive processes such as brewing, sterilization and pulping (Appendix 1). By contrast, utilities and power producers sit predominantly in the teal category and are more exposed to water-availability risk than to water-quality risk, highlighting their dependence on consistent water supply for cooling.

Exhibit 4. Industries with the highest share of companies facing water availability and water quality risk



Source: MSCI Biodiversity Risk Metrics, data as of January 2026. Our analysis uses the MSCI Biodiversity Risk Metrics, which flags a company as highly exposed if more than 5% of its revenue comes from facilities with a high biodiversity risk score (GSAI WWF BRF score above 3.4).

These metrics, however, overlook a critical subset of companies that, while not reliant on high water volumes, depend on water of adequate quality (magenta category) – a profile that can account for up to 28% of companies in the most affected industries. Such risks are particularly prevalent in industries with stringent water-quality requirements, including health care REITs with exposure to pharmaceutical manufacturing and biotech laboratory facilities.

The findings suggest that water-related risks are often multidimensional and compounding at the company level too. While water-availability metrics may flag companies as exposed, relying on them can lead to incomplete or misleading conclusions for risk mitigation. Securing sufficient supply does not eliminate exposure if water quality remains inadequate, underscoring the need to assess both quantity and quality.

Conclusion

Water risk spans two dimensions: availability and quality. Focusing solely on availability overlooks more than 115,000 company facilities that face significant exposure to water-quality risk, particularly in food and beverage production and hospitality.

Investors with holdings concentrated in these operations – especially in regions where quality risk is elevated, regardless of water availability – may face exposures that a single-dimension lens would not capture.

Considering both dimensions provides a clearer view of where water risk is most material.

Appendices

Appendix 1. Top 3 activities at key industry facilities

Industry	Most-frequent activity at exposed facilities			
	Activity at facilities	Percentage of facilities	Facility activity relevance	
			Water availability	Water quality
Food products	Food & beverage production	37%	5	4
	Offices & professional services	25%	2	2
	General or specialty retailing	24%	2	2
Beverages	Food retailing	72%	2	2
	Food & beverage production	12%	5	4
	Offices & professional services	12%	2	2
Paper & forest products	Paper & forest product production	55%	5	4
	Offices & professional services	25%	2	2
	Appliances & general goods manufacturing	10%	4	2
Multi-utilities	Offices & professional services	29%	2	2
	Appliances & general goods manufacturing	18%	4	2
	Electric energy production - geothermal or combustion (biomass, coal, gas, nuclear, oil)	17%	5	2
Electric utilities	Electric energy production - geothermal or combustion (biomass, coal, gas, nuclear, oil)	26%	5	2
	Electric energy production - hydropower	26%	5	3
	Offices & professional services	23%	2	2
Independent power & renewable electricity producers	Electric energy production - solar, wind	41%	3	2
	Electric energy production - geothermal or combustion (biomass, coal, gas, nuclear, oil)	26%	5	2
	Electric energy production - hydropower	15%	5	3
Health care REITs	Offices & professional services	53%	2	2
	Health care, pharmaceuticals and biotechnology	21%	4	3
	Appliances & general goods manufacturing	11%	4	2

Source: MSCI Biodiversity Risk Metrics, data as of January 2026. Only top 3 activities present in an industry's facilities are shown.

Appendices

Appendix 2. Metrics constituting water availability and water quality (BRF indicators)

BRF Indicator	Metric	Metric Description
Water quality	**Coastal eutrophication potential**	Measures the potential for riverine loadings of nitrogen (N), phosphorus (P), and silica (Si) to stimulate harmful algal blooms in coastal waters.
	Nitrate–nitrite concentration	Nitrogen (N) is a proxy for nutrient loading in water bodies. Based on predictions of nitrogen (nitrate/nitrite) in rivers, as an annual average, using monitoring data and a machine learning prediction model.
	Periphyton growth potential	Based on a global model of dissolved and total nitrogen (N) and phosphorus (P) concentrations and ratios to determine which nutrient limits periphyton proliferation during the growing season.
	Toxicity stress	Measures the negative effects experienced by aquatic systems due to chemicals and mixtures of chemicals that accumulate in freshwater ecosystems and harm aquatic life.
	Mismanaged plastic waste	Represents plastic waste that escapes into the environment from littering, illegal dumping, and poorly designed waste management systems. Highest in areas with poor waste management and high population densities.
	Risk of pesticide pollution	Based on pesticide pollution risk score and number of active ingredients posing environmental risk. Considers additive and synergistic effects of pesticides in aquatic environments.
	Total dissolved solids	Represents salinity for 2010–2019 based on dynamical surface water quality model (DynQual) results. Provides average monthly total dissolved solids (TDS) concentrations in mg/L.
	Surface water quality index – BOD	Biological oxygen demand (BOD) is used as a proxy for overall water quality. Based on DynQual model results for 2010–2019, showing average monthly BOD concentrations in mg/L to represent organic pollution.
	Surface water quality index – electrical conductivity	Electrical conductivity (EC) is a proxy for salinity balance and pH alteration linked to dissolved solids concentration in water, based on the World Bank's Environmental Water Quality Index.
Water availability	**Water depletion**	Measures the ratio of surface and groundwater consumptive use to available renewable water. Based on model outputs from WaterGAP3 to compute average annual and monthly values for 1971–2000, and to map seasonal depletion and dry-year depletion.
	Baseline water stress	Measures the ratio of total surface and groundwater withdrawals to available renewable water. Based on model outputs from PCR-GLOBWB2 to compute average monthly values for 1979–2019, then regression values for the year 2019 (baseline).
	Blue water scarcity	Measures the ratio of the blue water footprint to total blue water availability. Based on the global standard for water footprint assessment to compute average monthly values (10-year average for 1996–2005).
	Groundwater	Based on groundwater levels from the Global Land Water Storage dataset (GLWS) 2.0, modelled for 2003–2019. Represents the change in groundwater levels between the first five years (2003–2007) and the last five years (2015–2019), in mm, to indicate areas where groundwater levels are decreasing.

Source: WWF Biodiversity Risk Filter Methodology Documentation version 2.0, Oct. 24, 2024.

Appendices

Appendix 3. WWF Activity Relevance Matrix

			Agriculture (animal products)	Agriculture (plant products)	Appliances & general goods manufacturing	Automotive, electrical equipment &machinery	Chemicals & other materials production	Construction materials	Electric energy production –coal/gas/oil, nuclear oil, general production	Electric energy production – hydropower	Electric energy production – solar/wind	Electronics & semiconductor manufacturing	Fishing and aquaculture	Food & beverage production	Food retailing	General or speciality retailing	Health care, pharmaceuticals & biotechnology	Hospitality services	Land development & construction	*Metals & mining	Offices & professional services	Oil, gas & consumable fuels	Paper & forest product	Telecommunication services (including wireless)	Textile, apparel & luxury good production	Transportation services	Water utilities / water service providers	Other (average of all activities)
Physical Risk																												
1.1	Water Availability	Dependency	5	4	4	4	5	5	5	3	4	5	3	4	5	2	4	4	3	5	2	4	5	2	5	2	5	4
1.2	Forest Productivity and Distance to Markets	Dependency	0	0	0	0	0	4	0	0	0	0	0	0	0	0	0	2	4	4	0	4	5	2	5	2	0	1
1.3	Wild Flora & Fauna Availability	Dependency	1	1	0	3	1	1	0	0	0	0	0	3	0	0	0	3	2	4	0	4	5	0	2	2	0	1
1.4	Limited Marine Fish Availability	Dependency	0	0	0	0	0	0	0	0	0	0	5	0	0	0	0	0	2	0	0	0	0	0	0	0	0	0
2.1	Soil Condition	Dependency	4	5	0	0	0	0	0	0	0	0	0	3	0	0	0	0	3	3	0	0	3	0	0	0	0	1
2.2	Water Condition	Dependency	5	4	2	2	3	2	2	3	2	2	5	4	2	2	3	4	2	2	4	2	2	4	2	2	4	3
2.3	Air Condition	Dependency	4	4	3	4	3	3	3	3	3	3	4	3	2	2	4	4	4	3	4	3	3	3	3	3	3	3
2.4	Ecosystem Condition	Dependency	4	4	0	0	0	0	0	0	0	0	0	5	0	0	0	0	0	4	0	0	0	0	4	0	0	1
2.5	Pollination	Dependency	2	5	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	4	0	0	0	0	0
3.1	Landslides	Dependency	4	4	3	3	3	3	3	3	3	3	4	3	3	3	3	3	3	3	3	3	3	3	3	4	4	3
3.2	Wildfire Hazard	Dependency	4	4	3	3	3	3	3	3	3	3	4	3	3	3	3	3	3	3	3	3	4	3	3	4	3	3
3.3	Plant/Forest/Aquatic Pests and Diseases	Dependency	4	4	0	0	0	0	0	0	0	0	4	4	0	0	0	0	0	4	1	0	0	0	0	0	0	1
3.4	Herbicide Resistance	Dependency	4	4	2	0	0	0	0	0	0	0	1	1	0	0	0	0	1	1	0	0	0	0	0	0	0	1
3.5	Extreme Heat	Dependency	3	4	3	3	3	3	3	3	3	3	3	3	4	4	4	3	4	4	4	4	4	4	3	1	4	3
3.6	Tropical Cyclones	Dependency	4	4	3	3	3	3	3	3	3	3	4	3	3	3	3	3	3	3	4	3	3	4	4	4	3	3
4.1	Tourism Attractiveness	Dependency	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	5	1	0	0	0	0	0	0	0	0	1
5.1	Land, Fisheries and Sea Use Change	Impact	1	1	1	1	1	1	5	1	1	1	1	1	0	0	0	1	3	5	1	5	5	1	1	1	3	
5.2	Forest Canopy Loss	Impact	5	5	1	1	1	5	4	4	1	1	1	1	1	1	1	1	3	5	5	1	5	5	1	5	2	3
5.3	Invasives	Impact	3	3	0	0	2	0	2	0	0	0	2	2	2	0	0	0	2	2	0	0	2	0	0	0	3	1
5.4	Pollution	Impact	5	5	5	5	5	5	5	3	4	5	5	4	4	5	3	5	5	2	5	4	2	5	4	5	2	4
Reputational Risk																												
6.1	Protected/Conserved Areas	Impact	5	5	3	3	2	2	4	3	1	2	2	1	1	1	2	1	4	1	4	1	4	1	2	4	2	3
6.2	Key Biodiversity Areas	Impact	4	4	2	2	2	2	4	3	1	2	2	1	1	1	4	1	4	1	4	1	4	1	2	4	2	3
6.3	Other Important Delineated Areas	Impact	4	4	2	2	2	2	4	3	1	2	2	1	1	1	4	1	4	1	4	1	4	1	2	4	2	3
6.4	Ecosystem Condition	Impact	4	4	2	2	2	2	4	4	2	2	2	1	1	1	2	1	4	1	4	1	4	1	2	4	2	3
6.5	Range Rarity	Impact	3	3	1	1	1	1	3	2	1	1	3	1	0	0	1	1	0	1	0	1	2	1	2	2	2	
7.1	Indigenous Peoples (IPs); Local Communities (LCs) Lands and Territories	Impact	5	5	3	3	3	3	5	3	3	3	3	1	1	1	3	1	5	5	5	3	5	3	5	3	3	
7.2	Resource Scarcity: Food – Water – Air	Impact	3	3	1	1	1	1	1	1	0	1	2	2	1	0	1	3	3	2	0	2	1	1	2	1	1	
7.3	Labor/Human Rights	Impact	4	4	3	3	3	2	3	3	3	3	3	3	2	3	4	3	3	3	2	3	3	4	4	3	2	3
7.4	Financial Inequality	Impact	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2
8.1	Media Scrutiny	Dependency	5	5	3	1	4	4	2	2	2	1	5	5	3	4	3	5	3	1	3	1	1	3	1	3	5	
8.2	Political Situation	Dependency	3	3	2	2	2	2	3	3	2	2	3	3	1	1	2	3	2	3	3	2	2	2	2	3	2	2
8.3	Sites of International Interest	Dependency	3	3	2	2	2	2	3	3	2	2	3	3	1	1	2	3	2	3	3	2	2	2	2	3	2	2
8.4	Risk Preparation	Dependency	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2

Source: WWF Biodiversity Risk Filter Methodology Documentation version 2.0, Oct. 24, 2024.

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4. The WWF Biodiversity Risk Filter (WWF BRF) is a web-based tool that assesses nature-related risks at the physical locations of corporate assets (such as facilities, mines, and plants) across multiple environmental dimensions, including water availability and water quality. For more information see: “WWF Biodiversity Risk Filter Methodology Documentation version 2.0”, WWF, Oct. 24, 2024. WWF methodologies refer to water quality as water condition. MSCI GeoSpatial Asset Intelligence (MSCI GSAI) is a dataset that links the physical locations of corporate assets (such as facilities, mines, and plants) to their geographic coordinates, enabling the overlay of location-specific environmental risk data onto company-level investment analysis. For more information see: “MSCI GeoSpatial Asset Intelligence Fact Sheet”, MSCI, 2026.
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23. For more information see: “MSCI Biodiversity Risk Metrics Methodology”. MSCI Sustainability & Climate, March 2026.
24. GICS® refers to the global industry classification standard jointly developed by MSCI Inc. and S&P Global Market Intelligence. The GICS structure comprises 11 sectors, 24 industry groups, 69 industries and 158 subindustries.

About

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