BlackRock

Troubled waters

Water stress risks to portfolios

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Contents

An understated risk

The global pandemic has reinforced the importance of resilience in investment portfolios. This includes sustainability-related risks that investors may have been underappreciating, ranging from vulnerable global supply chains to health and safety issues. We believe increased asset flows into sustainable investing strategies in 2020 are part of a tectonic shift that could last decades.

Physical risks posed by climate events – ranging from hurricanes to wildfires – have captured growing attention in the investment community. We zeroed in on these risks in Getting physical of April 2019, painting a granular picture of the financial implications across municipal bonds, commercial real estate and U.S. utility equities.

In this piece, we extend our work on physical risks to water stress. What do we mean by water risk? One in four people globally live in regions at high risk of water scarcity – with water demand exceeding supply – according to the World Resources Institute (WRI). This creates financial risks that investors today may not be pricing in. Examples include rising spending needs (to raise water efficiency and meet tough regulations) and the cost of production disruptions (unavailability of water for agriculture or cooling power plants). Regulators are zeroing on such risks: A recent European Central Bank report included water stress among the physical climate risks it may require financial institutions to manage and disclose.

We use a similar approach to our previous work on physical climate risks. This involves geolocating physical assets, overlaying climate analytics to assess the granular risks in each location, and aggregating the data up to the entities that hold the assets to assess their overall exposure. We use the global real estate investment trust (REIT) market to illustrate water stress risks, due to the relative ease of geolocating the underlying property holdings. Yet we believe our analysis is pertinent across industries and sectors – and the risks of water stress are more financially material for areas with critical water needs (e.g. agriculture or electric utilities).

Our research, drawing on long-range projections on water stress from WRI, pinpoints water risks for 84,000 REIT properties globally – and the almost 600 public companies that own them. To be sure, the major drivers of REIT financials are fundamental factors such as interest rates and local economic growth. Yet we believe that water risks may grow in years ahead as urban population growth stresses resources for REITs and other companies alike.

Water stress is just one of many sustainability-related risks that we believe are becoming increasingly salient over time. Overall, the results underscore BlackRock's conviction that these risks cannot be ignored – and that integrating them into investment processes may produce more resilient portfolios.

Summary

- **Water stress – when demand for water exceeds supply – is a growing and underappreciated risk for regional economies and markets.** The causes are varied. Population growth and urbanization increase demand for water and strain resources. At the same time, climate change shifts the distribution of water supply by disrupting precipitation patterns.
- **Water stress has financial implications.** Companies with production facilities in water-stressed regions may face greater operating costs and insurance premiums. They will likely need to spend more on water efficiency measures, recycling and conservation – to meet stringent regulations that could tighten even further. In the real estate market, tenant preferences are likely to shift toward green buildings.
- **We use global real estate investment trusts (REITs) to illustrate how exposure to water stress can vary by location and over time.** Our approach combines the geolocation of specific REIT properties with an assessment of water stress at each location. This provides deeper insights on water-related issues faced by companies than traditional assessments, in our view. The risks are not unique to real estate – and we see our approach as applicable across asset classes.
- **Roughly 60% of the global REIT properties we were able to geolocate will experience high water stress by 2030, we find, driven by increased urbanization and the effects of climate change.** This is more than double the number today. Water-related issues are not yet a material cash-flow driver for REITs, in our view, and the risks can be mitigated. Yet they may become more material over time due to knock-on effects such as regulatory shifts.
- **Almost all REIT properties in Malaysia, Philippines, Japan, Hong Kong and Australia will likely be in high risk water zones by 2030, our analysis shows.** Roughly two-thirds of today's U.S. REIT properties will be at high risk of water stress by 2030, double the proportion today, we also conclude.
- **Investors and tenants are increasingly focused on water stress, as well as other environmental factors such as energy efficiency, green certifications and carbon footprints.** REITs that score highly on these metrics can potentially save costs, while screening as more "green." This may make their equities more attractive to potential investors and their buildings more desirable for occupants.
- **Water stress has wide-ranging implications across asset classes.** We show how the agriculture, electric power and food and beverage industries may be most at risk. The creditworthiness of some countries, states and municipalities facing water shortages could also come under threat as they face additional costs to fortify their water infrastructure. This comes on top of other growing physical climate risks such as exposure to flooding and other extreme weather events.
- **Companies resilient to water stress and other climate-related risks may fetch a premium in the transition to a more sustainable world, we believe**. Better understanding and quantifying the risks can help investors mitigate exposures and potentially exploit any mispricing. Related data and insights are valuable tools for investors to engage with companies and issuers on their sustainability-related efforts.

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Backdrop

Water stress is a risk often overlooked by investors. We explain its causes, why the problem is likely to intensify in the decades ahead – and sketch out financial implications.

Water: a scarce resource

Changes in the global climate have big implications for water supply. The total amount of water on the earth is relatively constant – as it moves through the hydrological cycle of evaporation, cooling, condensation, and then collecting in oceans, rivers, lakes and soil. Yet evolving patterns in rainfall location and intensity, snowpack, rivers and aquifers mean that the distribution of the global water supply is shifting. At the same time, the global demand for water has been increasing at a pace of 1% annually in past decades, according to the United Nations' 2018 World Water Development Report, as growing urban populations strain resources.

Water stress sets in when demand for water exceeds its supply. Higher water stress levels indicate greater competition among water users. This increases the costs of sourcing water, and forces conservation measures. Changing global precipitation patterns are not the only factor behind water stress. Others include lax environmental rules and pollution, which can reduce water quality and limit its potential use.

The geographic variation in climate patterns and human demand for water, together with changes caused by rising global temperatures, result in great variation in the distribution of water stress around the world.

The graphic below uses WRI projections that rank geographies' water stress from "low" to "extremely high" as of 2030. India, the Middle East, northern and southern Africa, Australia, and the U.S. Southwest stand out as likely high risk zones within a decade of today.

The financial implications

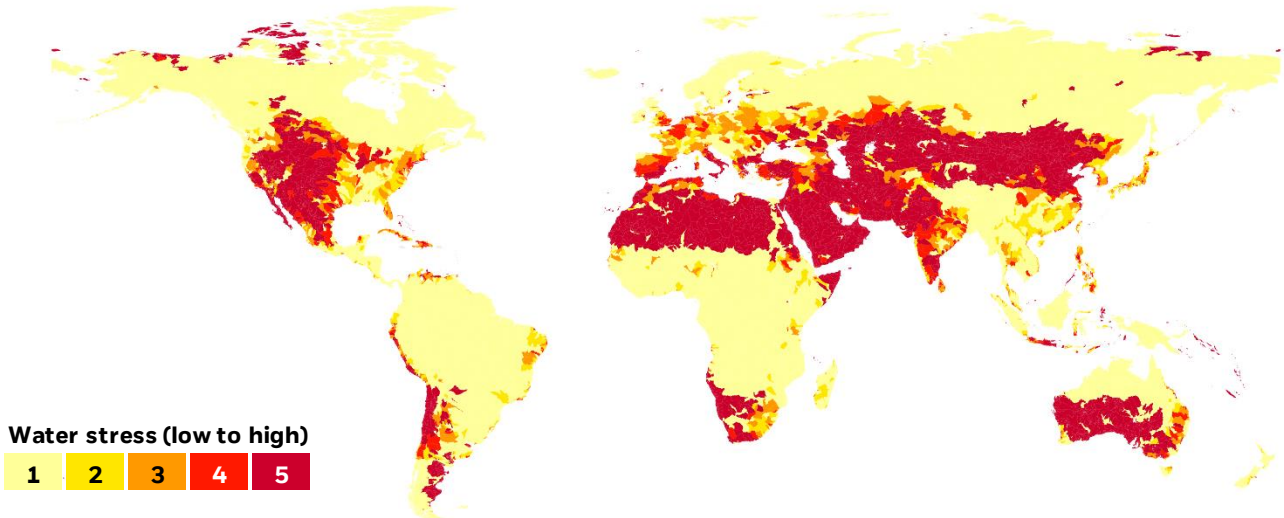
Industrial and commercial activity accounts for the bulk of freshwater use around the world. The agricultural, textile, energy, industrials, chemicals, pharmaceutical and mining industries account for around 70% of usage, according to CDP's 2018 Global water report. Residential and office use of water are part of the remaining 30%.

The financial implications of reduced water availability are varied. Companies in water-stressed locations can face costs from disrupted production, higher capital expenditures, compliance and enforcement penalties. They may need to spend more to mitigate the effects of water stress, such as investments in water efficiency, pollution abatement, water re-use, recycling and conservation measures. The takeaway for investors: Companies that manage water resources better than their peers may offer more resilient earnings streams.

The risks cut across sectors. Lack of water for irrigation and animal consumption threatens the food industry. Insufficient cooling water can cause brownouts in electric power plants, hurting electric utilities and their customers. Even the leisure industry may be affected: water shortages in India in 2019 forced hotel closures.

Water stress is expected to intensify in the decades ahead, in line with many of the other physical risks posed by climate change that we outlined in Getting physical of April 2019. One in two people will live in water-stressed locations by 2030, the UN Environment Programme (UNEP) expects. Global water infrastructure costs are expected to rise fourfold to $150 billion annually from 2017 levels by 2030, the World Bank estimates.

Competition for water
Projected water stress around the world by risk zone, 2030



Source: BlackRock Investment Institute and BlackRock Sustainable Investing, with data from WRI, July 2020. Notes: WRI defines water stress as the ratio of total water withdrawals to available renewable surface and groundwater supplies. Higher water stress indicates more competition among water users. Water withdrawals include those from irrigation, livestock, industrial use, and domestic sectors. Available supplies capture natural runoff as well as the impact of upstream water use and dam operations on downstream water availability. Water stress is assessed on WRI's five point scale, ranging from "low" to "extremely high" (1 to 5). For illustrative purposes only. Forward-looking estimates may not come to pass.

REITs as a case study

We use REITs to illustrate given the relative ease of pinpointing the physical location of their assets, as well as their predominant location in cities and their connection with local economies. The implications of water stress are wide-ranging, and we believe our method is applicable across asset classes. Our first step was geolocating about 84,000 global REIT properties and mapping them to the 590 publicly listed REITs that own them. We then used the WRI's "Aqueduct" model to assess REITs exposure to various water stress risks today and in the future.

What are some potential financial implications? New buildings in high water stress zones may become more expensive to build as environmental regulations tighten. Old buildings will cost more to retrofit. This may increase the cost for REIT owners as they cater to changing tenant preferences toward greener buildings. To be sure, water-related costs today make up a minimal share of operating expenses for the typical building today. Yet adoption of measures such as on-site wastewater treatment, smart irrigation and leak detection systems could become key differentiators for investors assessing a company's performance on water efficiency. And locations with peak climate-related business interruptions – including those from hurricanes, wildfires and flooding – could face higher insurance premiums and valuation discounts over time.

We use the U.S. Southwest to illustrate our methodology. The map on the bottom left paints the picture as of 2014. We use 2014 as our baseline because WRI's water stress data draw on an extensive modeling and simulation project ran by Utrecht University that spanned 1960-2014. This data represents the most recent and accurate global picture of water stress available, we believe.

Key assumptions

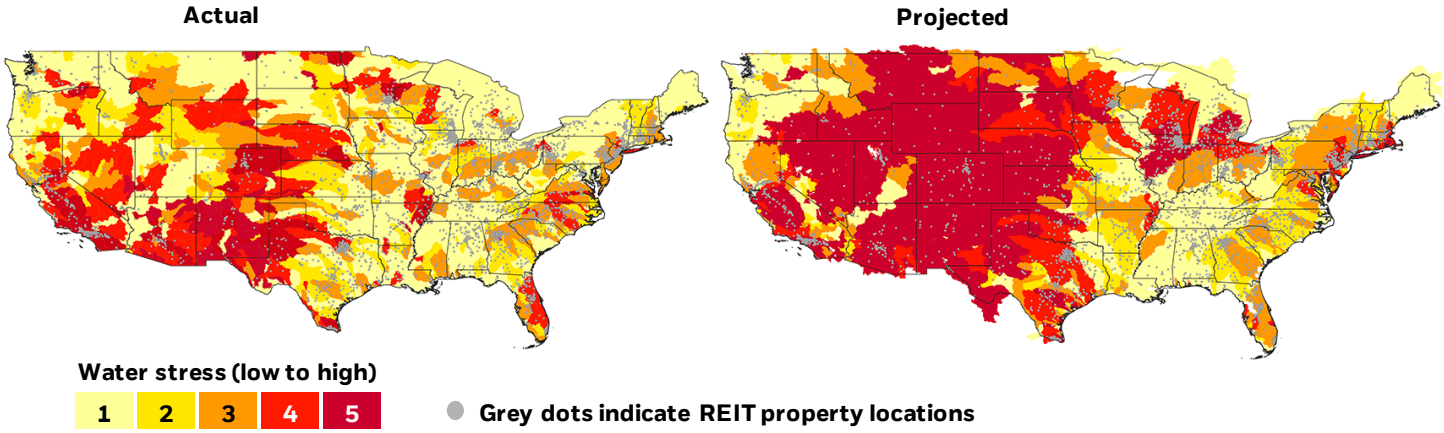
Almost the entire U.S. Southwest, including states such as California, Arizona, New Mexico and Utah, faces extreme water stress issues by 2030. See the map on the bottom right. Most of the current REIT properties in the region, indicated by the grey dots, lie in these high risk zones.

The 2030 projections are based on WRI's modeling of potential changes in water withdrawals and supply. They assume a "business as usual" scenario in which population and GDP growth trends do not stray markedly from historical patterns. It also assumes relatively unconstrained growth in global carbon emissions. See BlackRock's Getting physical of April 2019 for details on this "RCP 8.5" scenario. Scientists believe such a path would accelerate the effects of climate change such as extreme weather. How might this play out in the U.S. Southwest? Higher average temperatures could reduce the snowpack in the southern Rocky Mountains that flows into the Colorado River watershed and provides drinking and irrigation water for millions. This is just one of the reasons why water stresses may worsen over time.

REIT properties are concentrated primarily in cities, the key drivers of global economic activity. We supplement WRI's water stress projections for cities with urban water infrastructure data. Small cities typically rely on water sources within their basin. Yet large cities have the ability to source additional water from adjacent basins through canals and aqueducts, moderating their exposure to water stresses. A U.S. example is Boston. It is located in a water-scarce zone, but sources water through infrastructure networks spanning hundreds of miles that stretch into water-rich basins. Our adjustments to the WRI data take into account such water sourcing arrangements.

Stress in Southwest

Estimated water stress levels across U.S. Southwest, actual vs. projected



Source: BlackRock Investment Institute and BlackRock Sustainable Investing, with data from WRI and SNL, May 2020. The chart shows estimated water stress levels across the U.S. Southwest as of 2014 (actual) and 2030 (projected), using WRI data. Grey dots indicate properties held by listed global REITs, as identified by BlackRock using SNL's database. Water stress is assessed on WRI's five point scale, ranging from "low" to "extremely high" (1 to 5). For illustrative purposes only. Forward-looking estimates may not come to pass.

Financial risks

The geographic exposure of assets to water stress is on the rise. We detail regions and the types of companies potentially most at risk.

Gauging exposure

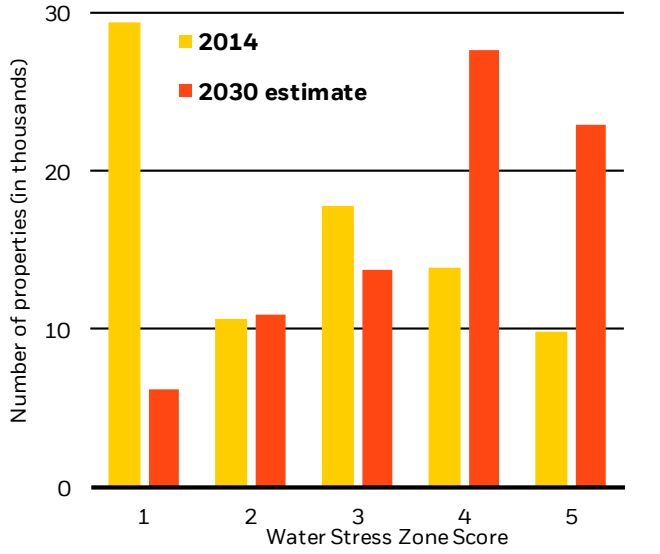
The potential financial connection between companies and water stress rests on the implications of operating in higher water stress zones. In our REITs example, this translates into property owners facing higher costs as they comply with more stringent regulations and cater to changing tenant preferences for greener buildings. See the following page for further details.

Water stress levels are set to intensify in the years ahead. How might this affect the REIT market? We used WRI data to assess the exposure to water stress of the more than 80,000 REIT properties in our study, spanning 74 countries. We first looked at the current distribution of REIT properties across different water stress zones. The results are shown in the chart below. Less than 30% of global REIT properties today lie in regions with high water stress (zone 4 or 5), according to WRI data.

That proportion more than doubles by 2030 under the "business as usual" scenario (assuming the footprint of REIT properties remains unchanged). Our estimates suggest that within a decade just 20% of properties would likely stand in areas at relatively low risk of water stress (zones 1 and 2), versus around half today. To be clear, the risks are not unique to REITs. Other businesses with similar urban footprints would be similarly effected.

Stressed out

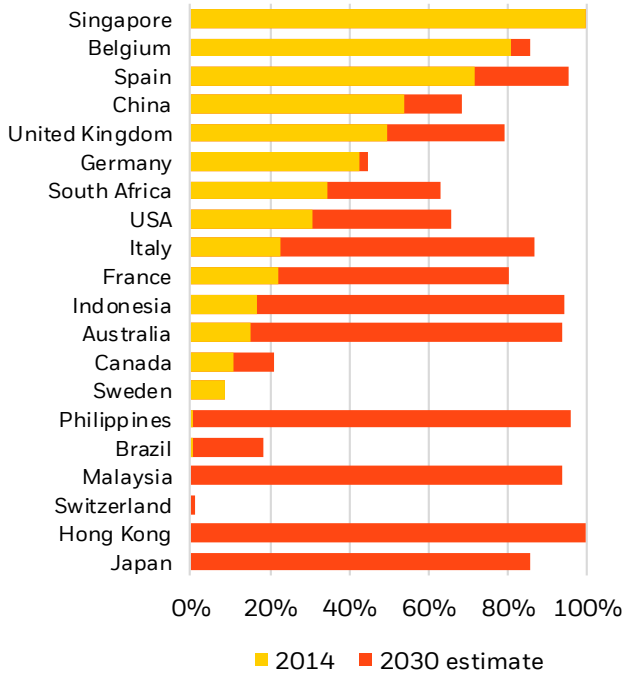
REIT properties across water stress zones, 2014 and 2030



Sources: BlackRock Investment Institute, with data from BlackRock, SNL and WRI, June 2020. Notes: The chart compares the distribution of global REIT properties in WRI's five water stress zones. We calculate this by geolocating around 85,000 properties in SNL's REIT database and overlaying WRI's water stress map. The yellow bars show the distribution in 2014 and the orange bars show our estimates for 2030, using WRI data to project water stress levels. The scale ranges from low (1) to extreme (5) water stress exposure.. We assume the 2014 footprint of global REITs stays unchanged. For illustrative purposes only. Forward-looking estimates may not come to pass.

Who's vulnerable?

Water stress exposure by REIT market, 2014 vs. 2030



Source: BlackRock Investment Institute, with data from SNL and WRI, June 2020. Notes: The chart shows the percentage of REIT properties in the top-20 global REIT markets that lie in regions with high water stress (zones 4 and 5 according to WRI's framework), both as of 2014 (baseline) and 2030. Projections are based on WRI data. We used the SNL database to geolocate around 85,000 global REIT properties owned by listed companies. For illustrative purposes only. Forward-looking estimates may not come to pass.

The projected rise in exposure to water stress is not uniform across countries and regions. We next aggregated REIT properties by country of location for the 20 largest global REIT markets, ranging from the U.S. (more than 43,000 properties) to Malaysia (around 400).

The conclusion: Only a few countries had the bulk of their REIT properties in zones of high water stress as of 2014. These included Singapore, Belgium and Spain. Yet we see a disproportionate and across the board increase in water stress exposure under the 2030 projection.

We believe many markets in which properties today have little to no exposure to water stress will likely face high risk within a decade. Malaysia, Philippines, Japan, Hong Kong and Australia may be among the hardest hit, according to the estimates. See the orange bars in the chart. Almost no region is immune, with Switzerland a notable exception.

Nearly two-thirds of properties in the world's largest REIT market – the U.S. – are set to lie in zones of high water stress by 2030, the projections show. That's more than double the share today.

A key focus

Water management is a key environmental focus for real estate management teams, investors and tenants. What are its financial implications? REITs with the highest exposure to properties (in our REIT example) or production facilities in water-stressed regions may face increased costs. These range from the direct costs of sourcing water to the need to spend more on water efficiency measures. Companies that are positioned well for these trends may outperform. See the *Be prepared* table below.

To be sure, water-related costs are not a material cash flow or value driver for real estate companies today, in our view. And some increased costs, such as water rates, can be passed on by property owners to their tenants. Yet the materiality of water stress could increase over time. The ramifications of water stress also go beyond the direct cost of water. Buildings in locations with severe water stress may face more stringent regulations on water efficiency in the future. Severe water stress can diminish the attractiveness of a location – for example by threatening the reliability of local electricity supply as the risk of brownout rises. This, in turn could affect migration trends and local demand for property.

On the flip side, water efficient buildings may have lower operating costs and a more attractive green profile, making them more attractive to both tenants and investors. Both groups are increasingly focused on environmental footprints, including energy consumption, green certifications and carbon emissions.

Be prepared

Key implications of water stress for REITs

Key measure	Implication
Water management	REITs with better water efficiency will be more appealing to potential tenants
Regulatory requirements	Increasing demands for more efficient water use in buildings will favor better prepared REITs
Operating efficiency	Better water efficiency results in lower expenses and more attractive buildings for tenants and investors

Sources: BlackRock Investment Institute, and BlackRock Sustainable Investing, July 2020. Notes: This material represents an assessment of the market environment at a specific time and is not intended to be a forecast of future events or results.

Water stressing portfolios

How might investors integrate analysis of environmental factors such as water stress into their investment process? One potential approach is to include an environmental, social and governance (ESG) risk premium when calculating REITs' cost of equity – a key input for estimating potential returns of individual companies.

Risk free rates and company-specific financial risks such as leverage and dividend payout ratios are other key components of the cost of equity for REITs. Within ESG, water-related risks can be incorporated through metrics such as water usage reduction targets, the percentage of water sourced from recycled sources, and overall water management. Other key "E" metrics include the share of a REIT's properties that are certified "green buildings," as well as energy, greenhouse gas and waste reduction targets. All else equal, higher exposure to ESG risks such as water stress can raise a company's cost of equity, thereby reducing its expected terminal value and attractiveness as an investment.

Companies' exposure to water stress is set to increase dramatically in the decades ahead, as we demonstrated on the previous page. It comes on top of other growing physical climate risks such as rising average temperatures and extreme weather events such as hurricanes and flooding. These risks are not yet sufficiently reflected in valuations, as we detailed in Getting physical of April 2019. Assets that are more resilient to such risks are likely to attract increased inflows in the long transition to a more sustainable world, paving the way for potential outperformance, in our view. See Sustainability: the tectonic shift transforming investing.

New data sources can help investors quantify climate-related risks such as water stress. These risks can then be incorporated into the security selection process to better inform analysis of potential risks and opportunities. Water stress and other sustainability-related risks are likely to have differentiated impacts across regions and companies, creating greater dispersion in asset returns. Investors that have a handle on the risks can potentially mitigate them and exploit any apparent mispricing.

Bottom line: Water-related risks are on the rise – and we expect regulators to increasingly demand more efficient use of water across industries. As a result, companies with better water efficiency will screen as more "green" to investors and potential tenants, making them more attractive to both groups. Water-related risks are local, and we think most REITs are handling them uniquely based on specific local challenges. Our approach, which combines the geolocation of REIT properties around the world with an assessment of water stress at each location, can provide deeper insights into the water-related issues faced by particular REIT companies, in our view.

Widening the lens

How might the analysis be extended beyond REITs? Our geolocation-based approach can also be applied to unlisted real estate – and a host of other asset classes and sectors, we believe. The materiality of water stress varies greatly across industries, as the *Who's at risk?* graphic below shows. Relatively high-water users such as the agricultural, electric power, and food and beverage sectors are among the biggest hot spots, this analysis from the WRI suggests.

The matrix assesses the materiality of various facets of water risk – ranging from baseline water stress to coastal flooding and droughts – across industries. The focus here is on risks related to water *quantity* – either too much or too little water. It does not address the full spectrum of water-related risks. Other components include risks related to declining water quality (water that is unfit for use); as well as reputational and regulatory risks (such as conflicts with the public over poor management of wastewater). This illustrates the complexity of assessing water risks across sectors – and the need to go beyond headline data. Yet we see it as a valuable starting point for assessing materiality of water stress across sectors.

The impacts could be dire in the agricultural sector, with a direct link between water availability for irrigation and crop yields. Irrigated agriculture is, on average, at least twice as productive per unit of land as rainfed agriculture, according to the World Bank.

Lack of water availability for cooling thermal power plants poses a serious risk to electric utilities. Some 27% of U.S. electric production would be severely impacted by steady increases in water stress by 2030, according to a 2017 study in Nature.

Cities and municipalities in water stressed regions may also face investment costs on wastewater recycling and fortifying their water infrastructure. This has implications for the debt of governments and municipalities. Moody's, for example, said in a report in early 2020 that climate-related risks posed long-term risks to the creditworthiness of the greater-Sydney region in Australia. It identified water stress as the single greatest challenge.

Challenges we plan to tackle include applying our analysis on water stress to companies with global supply chains. This would require a dataset identifying the location of all operating facilities of a firm so that the full exposure of companies – and their securities – can be determined.

Our understanding of the connection between climate risk and financial risk is evolving – and further research is needed to quantify effects with greater confidence. To be sure, rising water stress is not a one-way street. It can possibly be mitigated through breakthroughs such as better irrigation and wastewater treatment, and advances in water efficiency and desalination. Yet we have high conviction that water stress is a key component of climate risks that are set to grow increasingly relevant to investors over time. This suggests the time to integrate them into investment processes is now.

Who's at risk?

Water stress materiality matrix across major industries, 2020

Source: BlackRock Investment Institute, with data from WRI, 2019. Note: The chart shows the materiality across industries of various physical risks related to the quantity of water supply (too little or too much). The scale ranges from not relevant (white), to low (lightest tone) and very high (darkest tone). WRI's weights are based on information provided in corporate water disclosure reports and input from industry experts. For details on the methodology see Hofste, R., S. Kuzma, S. Walker, E.H. Sutanudjaja, et. al. 2019. "Aqueduct 3.0: Updated Decision-Relevant Global Water Risk Indicators." Available online at: https://files.wri.org/s3fs-public/aqueduct-30-updated-decision-relevant-global-water-risk-indicators_1.pdf All sectors represent WRI's assessment, except for REITs, which is based on BlackRock's analysis replicating the WRI methodology. For illustrative purposes only.

References

BlackRock (February 2020), Sustainability: The tectonic shift transforming investing

BlackRock (April 2019). Getting physical: assessing climate risks

Andre Bertolotti, Tianyi Luo and Yuxi Suo (July 2020), Impacts of water stress on physical assets using REITs as a case study, SSRN

CDP (2018), Treading Water: Global Water Report 2018

European Central Bank (May 2020), Guide on climate-related and environmental risks

Nature (September 2017), U.S. power production at risk from water stress in a changing climate

United Nations (March 2018), World Water Development Report 2018

UNEP (March 2016). Half the World to Face Severe Water Stress by 2030 unless Water Use is "Decoupled"

The World Bank. (August 2017), Millions Around the World Held Back by Poor Sanitation and Lack of Access to Clean Water

The World Bank (May 2020), Water in agriculture

WRI (May 2020), Water: mapping, measuring and mitigating global water challenges

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