INFERENTIAL FOCUS

*in*FOCUS Context Update

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Risk Assessments: Climate Change's Networked Effects

In September, the Securities and Exchange Commission (SEC) sent letters to dozens of public companies asking them to provide more information to investors about how climate change might affect their financial earnings or business operations. The letters were sent to firms in industries including agriculture, oil and gas, banking, real estate and trucking. Then, in early October, the White House released the climate adaptation plans for 23 U.S. government agencies, including Energy, Defense, Agriculture, Homeland Security, Transportation and Commerce. The documents included information on the dangers that climate change could pose to almost every industry, as well as society at large. The SEC request and the White House plans illustrate that the *effects* of climate change are not linear but rather are networked, with impacts far beyond the prevention and cleanup of the next hurricane, drought or fire. Yet the fact that the SEC didn't send letters to every public company also suggests that while the cascading challenges that come from climate change are starting to become recognized, the pervasiveness of the effects are not. While some of climate change's networked effects are still theoretical, the impacts of global warming are already being felt in areas including energy and power generation; mining; food and beverage; infrastructure; logistics and trade; travel and leisure; and mental health. (*Wall Street Journal,* 9/22/21; *New York Times*, 10/7/21)

The Original Context

In Part II of our October *Briefing* on risk assessment last month, we wrote, "The risks outlined in Part I of this *Briefing* are having a leveraging effect on damages – that is, the damage from one is making the damage for another worse.…This negative cycle of effects is causing problems for insurance companies, corporate benefit packages, employment, military preparedness, mental healthcare, electricity systems, social order, food production and other aspects of the economy." We suggested that several conclusions could be deduced from converging risks and assessment failures, including the elevated risks in a networked economy (see **IF 4217**).

New Observations: Energy and Power Generation

- In Brazil, receding water tables are emptying hydroelectric reservoirs in a nation that relies on water to power the majority of its electric grid. Hydropower losses now equal five months' worth of energy consumed by Rio de Janeiro. Brazil announced it would increase domestic energy prices by more than six percent in response.
- At Russian state-owned PAO Gazprom's gas-producing Bovanenkovskoye field, the company has had to install 1,000 vapor-liquid cooling units, which circulate a refrigerant to keep the permafrost frozen and operations uninterrupted.
- Because of drought conditions, the U.S. Energy Department said it expects domestic hydropower output to fall 14 percent this year from 2020. That includes a 12 percent drop in power generated in the Columbia River Basin, and a 49 percent decline in power generated in California.

•Lake Powell, on the Arizona-Utah border, provides the input for the Glen Canyon Powerplant. In July, decreased waterflow, forecast this year to be 30 percent of the historical annual average, brought the lake to a record low level and prompted a scheduled release of 181,000 acre-feet from upriver through December.

(*Washington Post*, 9/24/21; *Engineering News-Record*, 10/4/21; *Wall Street Journal*, 10/5/21)

New Observations: Mining

•Chile's copper mining industry, which is responsible for 10 percent of the nation's economic output, is reliant on water for processing. The president of the Chilean Mining Chamber claims that the lack of water caused by drought could lead to a drop in production of between 2.6 percent and 3.4 percent this year, or up to $1.7 billion in losses.

•Alrosa, one of the world's largest diamond producers, has 82 percent of its reserves in permafrost areas in Russia. The company has added "freezing columns" to its mines to keep the ground frozen and its infrastructure operational.

•In Russia, PAO Severstal is building structures on stilts to better adapt to the shifting ground caused by permafrost melting.

(*Washington Post*, 9/24/21; *Wall Street Journal*, 10/5/21)

New Observations: Food, Water and Beverages

•Because of drought in Chile, the government has declared an agricultural emergency in eight of its 16 regions and is offering aid to its farmers. In some regions of the country, rainfall losses are between 62 and 80 percent.

•The most recent four-year drought in Madagascar is being partly blamed for what the United Nations is calling the first climate famine. The UN estimates that 30,000 people in that country are currently experiencing the highest internationally recognized level of food insecurity – level five.

•Water levels in the Paraná River in Argentina, Brazil and Paraguay have reached lows not seen since 1944. Ranchers are now herding cattle across dried-up riverbed where barges once traveled.

•A drought along with unusually cold temperatures in Brazil has damaged coffee crops. In July, the price of Arabica beans hit a seven-year high.

•In August, for the first time in history, the Colorado River was declared by the U.S. government to be in a state of shortage. This cut the supply of water to some of the 40 million people who depend on the Colorado.

•Farmers in Arizona are curbing water use because of the decline in the Colorado River.

•Last year, Colorado had its worst fire season on record, with three of the largest fires in the state's history and more than 600,000 acres burned. This July, heavy rain pushed sediment from last years' fires down mountainsides and into the rivers that supply most of the state's water. In Glenwood Springs, the water was so polluted with sediment that the town twice had to shut off the valves that pump water to avoid overwhelming its filtration system.

•Lake Powell, which as previously noted is at a record low and faced a water shortage for the first time ever, provides irrigation and municipal water to Wyoming, Utah, Colorado, New Mexico, Arizona, Nevada and Nebraska.

(*Washington Post*, 9/24/21; *Bloomberg BusinessWeek*, 9/27/21; *Kaiser Health News*, 9/28/21; *Engineering News-Record*, 10/4/21)

New Observations: Infrastructure

- In Russia, 40 percent of buildings and infrastructure facilities located on permafrost-covered areas have already been damaged due to the permafrost's thawing.
- Trains in Russia are now running at slower speeds because of deformed tracks caused by the thawing of permafrost.
- In Alaska, highways and roads now require repair because of cracking, heaving and sinking caused by the permafrost's thawing. The top layer of permafrost at the northern site of Deadhorse has warmed by 1.5 degrees per decade since the 1970s.

(*Wall Street Journal*, 10/5/21)

New Observations: Logistics and Trade

- The Paraná River is the second most popular trade route in South America's Southern Cone. Drought and shrinking water tables in the Paraná have made it so that barges are having a difficult time using the route. To avoid being grounded, barges are running with lighter loads, causing costs to increase by as much as 25 percent and transit times to triple. Losses are expected to hit $100 million this year, according to the director for the Paraguayan shipping industry group CAFYM.

(*Washington Post*, 9/24/21)

New Observations: Travel and Leisure

- Seven of 12 ski lodges under the Chilean Ski Areas Association banner have opened late or have suffered interruptions because of a lack of snow.

(*Washington Post*, 9/24/21)

New Observations: Mental Health

- Nearly 60 percent of 16-to-25-year-olds said they are "very worried" or "extremely worried" about climate change, according to a recent study of 10,000 young people in ten countries. The most commonly chosen emotions associated with climate change were "sad," "afraid," "anxious," "angry" and "powerless." Overall, 45 percent of participants said their feelings about climate change affected their daily lives.

(*Nature*, 9/30/21)

In a networked world, risks become magnified, actually increasing exponentially, similar to the spread of the novel coronavirus. The COVID-19 pandemic illustrated how threats with networked effects are difficult to manage, in part, because it can be challenging for governments, companies and institutions to recognize all the connected areas of society and the economy that will be impacted. Some early networked effects of climate change are already being felt, but other impacts will be numerous and lead to unpreparedness, unrecognized risks and tremendous mitigation costs.

Some Potential Implications

- Costs of implementing preventive measures and of repairing damages will increase – impacting economic productivity.
- Spending on climate change adaptation technologies will increase.
- Supply chains will be disrupted more frequently, leading to shortages.
- Conflicts over access to water will increase.
- Reduction of gas production from the Russian permafrost fields will affect China's energy supply.
- Reduction in hydropower will raise electricity costs.
- Costs for raw materials will remain elevated.
- Insurance and reinsurance premiums will increase.
- Challenges to the farming supply chain will mean higher costs, and investments in indoor farming will see an increase.
- Farmers will be forced to reduce plantings to preserve water.
- Farm machinery sales will suffer.
- The travel and leisure industry will be volatile.
- Potential for bacterial infections from melting permafrost will grow.
- Youth political activism will increase.
- Corporations will choose to relocate to locations less severely impacted by climate change.
- Engineers and engineering firms will be in greater demand.
- Air travel schedules and airlines will continue to experience upheaval.