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Vector Center
Responding to the world's water crises with AI

Summary

Around the world, billions of people lack access to reliable and safe water sources, and an increasing number of major population centers face the threat of "day zero," the day when an urban water supply fails. Besides shifting weather patterns and extended droughts, governmental policies, people's beliefs and behaviors, historical context, and infrastructure conditions all play roles in whether and when a potential shortage of water quickly reaches acute danger of collapse. Historically, a lack of available, accessible data on these factors has created dangerous gaps in situational awareness that exacerbate water crises. Those gaps can quickly translate into operational failures, political and reputational problems, civil unrest, and supply chain disruptions. Now, Vector Center has created a new set of AI-powered tools and processes to provide decision makers with real-time, contextualized intelligence about water and intersecting threats. By comparing the dissonance between perception and reality, and putting data into actionable context, Vector Center empowers governments, agencies, and businesses avoid catastrophic failures like day zero and create a more water secure world.

Helping the world avert water crises through AI

Water is vital for everyday life, directly sustaining people as well as enabling hygiene, sanitation, and food and energy production. Yet, the World Health Organization (WHO) reports that as of 2017, 29 percent of the world's population, or 2.2 billion people, lacked safely managed drinking water—a source on premises, available when needed, and free from contamination. Of those people, 785 million do not even have a drinking water source within a 30-minute round trip. And in its 2020 report on progress toward the United Nations (UN) Sustainable Development Goal 6: Clean Water and Sanitation, the UN states that 3 billion people lack basic handwashing facilities—especially perilous as the world battles the COVID-19 pandemic.

These problems only threaten to grow worse as climate change ripples around the world, increasing water scarcity in areas already challenged to meet the needs of growing populations. The WHO predicts that half the world's population will live in water-stressed areas by 2025. In its annual Global Risks Report, the World Economic Forum has placed water crises among its top ten global threats for years. In the 2020 report, it recategorized water crises as a societal risk, in recognition of how broad the effects of a water crisis are,

wreaking havoc with everything from food supplies to industry, energy production, political stability, and human wellbeing.

For the first time in history, more people live in urban areas than rural. The added stresses on water from overuse, pollution, and climate change has sparked an ominous new term, "day zero": the day when a city's water supplies become severely constrained or fail altogether. After suffering from three years of drought, in early 2018 the city of Cape Town, South Africa faced the imminent threat of its water reserves dropping so low that the city would have to shut off the supply lines to most of the city—effectively, the day of zero water availability. Although Cape Town successfully averted the worst of the crisis through restrictions that cut daily usage by more than half until the rains finally returned, the threat of day zero still looms heavily. Cape Town is far from the only major city facing this acute risk of running out of water. More than a dozen other major world cities face similar threats, ranging from Beijing to London, Moscow to Miami, São Paulo to Jakarta. The number continues to grow.

Overcoming the challenges of water scarcity and data scarcity

The day-zero risk involves more than unexpectedly long droughts or other weather disruptions. Just as important as the actual physical conditions are the beliefs and behaviors of the local population. How resilient and responsive are societal and government structures? For instance, if a city has never before in modern history suffered from a water shortage, people and their leaders may be slow to modify their behavior, exacerbating the stresses. Conversely, when governments, businesses, and citizens are informed about imminent threats, they can activate innovative, collective responses.

"We're peeling back the layers of one of the world's most urgent challenges," says J. Carl Ganter, president and founder of Vector Center. "We're helping steer a course toward a more equitable, resilient future because when we talk about food, energy, and climate, we're really talking about water at the most fundamental level."

"We found *everywhere* the data is siloed, it's delayed and too slow, it's out of context, and it's not inclusive or scalable."—Carl Ganter, CEO, Vector Center

Vector Center was spun off from Circle of Blue, an organization also co-founded by Ganter of award-winning journalists and scientists that reports on water crises worldwide and helps inform the people and organizations that can provide solutions.

Through these investigations, Ganter and Circle of Blue discovered water wasn't the only problem; data was, too. "We found *everywhere* the data is siloed, it's delayed and too slow, it's out of context, and it's not inclusive or scalable," says Ganter. Too often still, the data is also not yet digital and online, but bound up in stacks of printed reports. These problems with data access and availability translate into problems for governments and businesses that face water challenges which threaten infrastructure, geopolitical stability, and human and environmental health. "We have discovered huge situational awareness gaps that reach across climate, location, overuse, population, droughts, floods. That translates into operational failures, political risks, reputational risks, civil unrest, and supply chain disruptions," explains Ganter. "The best news, though, is when we understand these complexities, we can avoid billions of dollars of damage, lost lives, and lost livelihoods."

For more than a dozen years, teams of reporters at Circle of Blue have been on the frontlines of the world's water crises, reporting from five continents and convening leaders at events like the World Economic Forum's annual meeting in Davos, Switzerland. Yet traditional journalism isn't enough to inform responses to such profound challenges, Ganter says. "Our biggest question that drove us to found Vector Center was, how can we create a common operating platform, in a sense a digital heads-up display, that reveals what's happening now, where are the greatest risks, and what's that course correction we need to make—and provide that in real time? Our epiphany was that we could build new, dynamic tools using vast amounts of data, analysis, context, and machine learning."

Producing a strategic picture of water risks

The result is Vector Center's Perception Reality Engine, a common operating platform that unites disparate data—perception, reality, and context—for a strategic, systemic picture of water crises. Building on Microsoft Azure cloud computing and AI tools, the Perception Reality Engine creates a dynamic display of water availability around the world that highlights hot spots where crises are occurring or may soon occur. Data ranging from rainfall to surface water amounts, plant growth, and more is displayed in different layers, showing current and projected conditions. News reports—in addition to social media and other indicators—are shown in yet more layers. This dashboard allows analysts to quickly see and compare perception—public and professional sentiment—to reality—the scientific, trusted data.

"With Microsoft Azure we have built a real-time, common operating platform for water, providing key decision makers with intelligence to correct the world's dangerous course."—Ganter

"Our imperative mission is to understand the most important intersections of data and intelligence, discern what they mean for the future, and what it means for our clients' operations, engagements, and investments,"
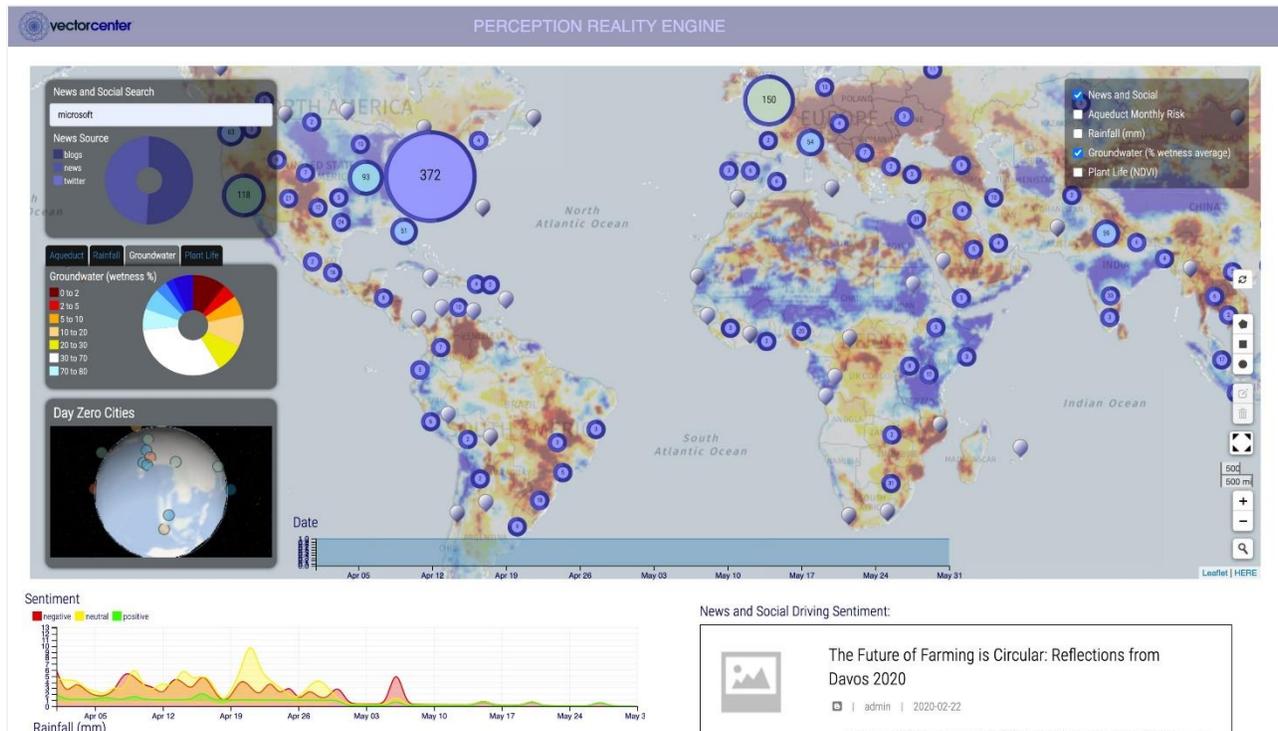
Using their Perception Reality Engine™, sentiment analysis, on-the-ground investigative reporting, and predictive analytics about freshwater availability, Vector Center paints scenarios and gives probabilities for crises in supply chains, risks of environmental hazards, or other situations. (Image courtesy Vector Center)

says Cody Pope, Vector Center's VP of Analytics and Research. "I come from the political risks realm and focused heavily on resource conflict. We wondered what we could achieve with automation and machine learning while adding context and deeper data and information."

By applying AI-powered risk metrics from many sources, including the World Resources Institute's [Aqueduct](#), Vector Center analysts can further develop their understanding of the situation on the ground and better identify areas of concern. Risk metrics consider not just physical risks, such as drought conditions, but also infrastructure risks, such as an aging supply system that's found to be leaking a lot of water, and governance risks, such as a lack of policies to manage water. "Traditionally, political and resource risk analysis has been analog and slow," Pope says. "We took a different, solutions-based approach by asking better questions and integrating real-time digital analytics. This allows us to combine many more data sources, be nimble in our forecasting, and build a product that clients rely on from day one." If one data type indicates an acute risk, the analysts can compare with other types to see what might exacerbate or ameliorate the risks—such as changes in government policy. The data can also be analyzed to determine the drivers of risk in that city or region.

Vector Center's Perception Reality Engine uses AI and machine learning to find long-term correlations between perception-based and reality-based data. Microsoft Azure Cognitive Services provide advanced sentiment analysis on perception data such as news reports to determine not just what people are saying about water-related topics but how favorably or unfavorably they view the situation. Azure Machine Learning builds a predictive model for both perception and reality data, learning what the correlations between the two indicate for future water crises. As the model learns to identify these correlations, it will be able to provide alerts when action is needed, and also indicate how the various risk metrics have changed. Azure Maps also provides geocoding through text analysis, correlating the data and analyses to the appropriate locations around the globe. Ganter says, "With Microsoft Azure we have built a real-time, common operating platform for water,

In depth reports, combined with automated monitoring, help companies, NGO, governments, and other stakeholders better understand their exposure to water risks, as well as possible opportunities to help mitigate those risks. (Image courtesy Vector Center)

providing key decision makers with intelligence to correct the world's dangerous course."

In addition to the global overview provided by the portal, Vector Center offers integrated and dynamic intelligence briefs on day zero cities informed by the Perception Reality Engine in real time. The reports provide information on the current water situation and risk analysis, along with a record of past analysis, and contextual

information such as a review of news around the city's water history and background details about the infrastructure, governance, and other sources of risk. In-depth reports can include embedded video clips, such as interviews with locals affected by the water situation, and more detailed reporting on special features and specific concerns. For example, a report on Chennai, India, explores how management of its water was altered by changes in city planning and infrastructure, which in turn caused widespread civic disruption when the historic cycles of drought and flooding intensified due to climate change and the distribution network proved inadequate.

Transforming the world with AI-driven foresight

Initial development of the Perception Reality Engine is focused on a subset of cities around the world facing the day-zero threat of water shortage. Pope says, "Our current work is city-focused, but the ultimate goal is more global and more universal." Ganter adds, "We want to look at whole systems—say a watershed or an entire river basin such as the Mekong or Mississippi—parse out what we think we know versus what the real data is telling us, and be able to do real-time comparisons."

The threat—and reality—of water crises continue to place in the top ten global risks, in both likelihood and impact, of the World Economic Forum's [Global Risk Report](#). It's an "amazing, profound challenge," Ganter says. "In Jakarta and Delhi, for example, there are thousands of undocumented wells that are literally draining the groundwater—and it's a metaphor for what's happening around the world." However, he also sees this time as a rare moment for systemic change. "The opportunity for transformation has never, ever been higher. A time to entirely reset how we're managing our water supplies."

About Vector Center

Vector Center helps global and local corporations, institutions, and governments understand the impact of rapidly changing water, food, and energy resources on supply chains, sustainability, and brand value. With decades of experience and its proprietary Perception Reality Engine, the company identifies and mitigates risks, guides investment decisions, ensures business continuity, and protects profitability and shareholder value with unparalleled accuracy, context, and foresight.

Its unique proprietary approach combines state of the art satellite data, social sentiment analysis, and on-the-ground investigative research backed by a network of best-in-class experts. Vector Center's team has decades of experience dedicated to water security and has advised the World Economic Forum, Fortune 50 CEOs, governments, industry policy makers, and the Vatican. Its team includes world-recognized environmental scientists, independent strategy consultants, researchers, data scientists, and journalists.

Resources

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Vector Center home site

Press

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