AI for Earth Grantee Profile
Leadership Counsel for Justice and Accountability
Forecasting regional-scale water shortages

Summary

Residents in California's rural Central Valley often rely on private domestic wells for drinking water, but many of these wells are vulnerable to failure when groundwater levels fall due to drought or unsustainable management. In fact, for the past century, Californians have consumed more water in any given year on average than has been naturally replenished in aquifers. Using historical groundwater level data, Leadership Counsel for Justice and Accountability and UC Davis work to predict groundwater level trends; this output is then lined up with the state's Well Completion Report database, which shows the location, depth, and type of wells (agricultural, public supply, or domestic). Algorithms are applied to determine how vulnerable each well is to failure, based on both pump location and local groundwater levels.

Using data to predict well failure in underserved communities

Around 1.5 million residents in California rely on private domestic wells for drinking water; around one-third of those residents live in the Central Valley. However, environmental factors put the level of these wells in jeopardy. California has experienced an increasingly warmer, drier climate, and with this, more extensive heat waves and extended droughts. By the end of the 21st century, the state's future snowpack is expected to

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decline by as much as 79.3 percent, and drought frequency in the Central Valley may increase by more than 100 percent. "California has run a groundwater deficit of around 150 million acre-feet over the past century," says Rich Pauloo, PhD candidate in hydrogeology at the University of California, Davis (UC Davis). "For perspective, this is approximately three times the total surface water storage capacity of all of California's major reservoirs." Given these figures, there is greater urgency to address these challenges with a combination of

scientific insights and political willpower, particularly by advocating for underserved populations often disproportionately affected by environmental disasters.

[Leadership Counsel for Justice and Accountability](#) works to mitigate inequities in governance structures by transforming decision-making culture to be more transparent and democratic. Particularly, the group focuses on healthy land-use planning, transportation, housing, climate change, and safe drinking water and wastewater.

Communities such as Tooleville in California's Central Valley often do not have a reliable source of water.

Recognizing that lower income and small communities often face the largest barriers to safe and reliable drinking water, Leadership Counsel is working with Pauloo at UC Davis to ensure secure water supplies by predicting and preventing well failure. "It's been a struggle to really get local agencies to take drinking water needs for disadvantaged communities seriously, because unfortunately, a lot of folks who are on the local agencies making these decisions about groundwater management are the same people who benefit from the lack of groundwater management," says Amanda Monaco, policy coordinator for water programs at Leadership Counsel.

Modeling well failure using existing datasets

Building upon existing research, Leadership Counsel will assimilate data from disparate sources, using Microsoft Azure resources to host and deploy machine learning models, then create a dashboard that people

can interact with on a server. The dashboard will provide regulators, advocacy groups, and the public with scientifically informed estimates of the impact of extreme drought events on drinking water availability.

Project inputs include well completion reports that detail well construction information, seasonal groundwater levels, observed domestic well failures from 2012 through 2016, and US Census bureau data, including income and ethnicity information, from a 2017 survey. The census information will be used to reveal the potential impact of well failure in underserved communities.

Informing policy changes with AI-supported predictions

The dashboard, co-developed with UC Davis, will provide a clear visual to decision makers and stakeholders around the state who are interested groundwater sustainability, showing where groundwater levels are declining and the effect this has on the population. The tool can model how many wells are going to go dry if groundwater reaches particular levels. With that information, the government and community can come together to create lasting positive change for historically underserved groups in California's Central Valley. Leadership Counsel hopes to prompt decision makers to be more protective of drinking water and see policy changes that keep groundwater levels up so that local wells don't go dry.

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The AI for Earth grant gives Leadership Counsel the funding to establish models and workflows that may not otherwise be funded. "Microsoft is the perfect funder for this type of project because it relies so heavily on the analysis of data, which is increasingly done in the cloud, and it provides servers to host interactive dashboards," says Pauloo. "The grant is really pivotal. The cloud compute resources to host and deploy the machine learning models, workflows, analyses, and ultimately, the dashboard that people will interact with on a server, is really valuable. All of that can get expensive, and if Microsoft didn't grant us funding for that, it probably wouldn't have happened." This contribution also allows Leadership Counsel to engage in wider community outreach efforts, advocating for policy efforts that will protect well water levels and inform residents about the potential impact of water conservation policy efforts.

Leadership Counsel and UC Davis will ensure that this project provides lasting impact by creating a robust modeling framework to estimate well failure. An interactive dashboard will supply a map of groundwater decline and locations of well failures, the median income of homes affected by failing and vulnerable wells, and

cost estimates to deepen wells or secure alternate water supply. Leadership Counsel will promote the dashboard to the public, government agencies, and advocacy groups via blog posts, social and news media, webinars, and a launch event with the aim to drive sustainable groundwater management practices. Because of Leadership Counsel's model of community organizing, local and statewide policy advocacy, and legal representation, they are uniquely positioned to improve access to water for residents and communities in the Central Valley.

About Leadership Counsel for Justice and Accountability

Since its inception in 2013, Leadership Counsel for Justice and Accountability has addressed inequities inherent in and fundamental to local, regional, and state governance structures. The group is committed to transforming the culture in which decision-making occurs to one that is equitable, transparent, and genuinely democratic in nature. The Leadership Counsel team has grown to a staff of 22 advocates across four offices located in Indio, Bakersfield, Fresno, and Sacramento, California.

Resources

Websites
[Leadership Counsel for Justice and Accountability](#)

Documentation
Cheryl A. Dieter, et al. *Circular 1441: Estimated use of water in the United States in 2015*. U. S. Geological Survey. June 19, 2018. https://pubs.er.usgs.gov/publication/cir1441

Alan M. Rhoades, Andrew D. Jones, Paul A. Ullrich. *The Changing Character of the California Sierra Nevada as a Natural Reservoir*. American Geophysical Union. November 20, 2018. https://doi.org/10.1029/2018GL080308

Daniel L. Swain, et al. "Increasing precipitation volatility in twenty-first-century California." *Nature Climate Change*. Macmillan Publishers Limited. 2018. https://doi.org/10.1038/s41558-018-0140-y