

Testimony of Dr. Sean McKenna
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Senate Subcommittee of Public Lands
Legislative Hearing on S. 2568
June 7, 2022

Thank you, Chairwoman Cortez-Masto, Ranking Member Lee, and members of the Subcommittee for inviting me to testify today on behalf of the Desert Research Institute (DRI) and the OpenET Consortium. My name is Sean McKenna, and I am the Executive Director of Hydrologic Sciences at the Desert Research Institute, located in Nevada.

DRI is part of the Nevada System of Higher Education and is home to a diverse group of scientists dedicated to research, development, and educational services in the fields of atmospheric, hydrologic, and ecosystem sciences.

Today I am speaking in support of S. 2568, the Open Access Evapotranspiration Data Act.

1. S. 2568, the Open Access Evapotranspiration Data Act

I would like to begin by thanking Senator Cortez Masto for her leadership in advancing this critically important bill to today's hearing. State and local water agencies in Nevada, Wyoming, Utah, Oregon, Washington, and California, and OpenET partners in these states are appreciative of the work of Senator Cortez-Masto (NV) as well as Representatives Lee (NV), Stewart (UT), Huffman (CA) and Owens (UT) to authorize a program at the U.S. Department of the Interior's U.S. Geological Survey (USGS) to produce field-scale (30 x 30 m) ET data for the Nation through S. 2568 and H.R. 4832, the Open Access Evapotranspiration Data Act. OpenET is a consortium that has worked over the past five years to build a satellite-based ET cloud computing and data services platform that begins to address this critical data gap for water management. The OpenET team looks forward to working with the USGS and other partners under this bill to continue to advance this important work. Before addressing the bill, I'll provide some background and discuss the partnerships that have established the foundation for this bill, highlight just a few of the many use cases to date that have successfully used ET data for on-the-ground applications, and then close with some additional information about the accuracy of satellite-based ET data, peer review, privacy, and sustainability.

Background

As members of this subcommittee are very aware, record drought has made water management in the western U.S. one of the most challenging and critical natural resource issues of our time. Forty million Americans rely on the Colorado River, which supplies municipal water, agricultural irrigation, and hydropower. For the first time ever, a shortage declaration has been made on the

river, forcing mandatory reductions in water use. To maximize the benefits of our water supplies during times of scarcity, we must know how much water is available, how much is needed to continue to grow our crops, and how much water is being consumed through evapotranspiration, or ET - the combined process of evaporation from soil and transpiration from plant leaves.

ET is a core driver of the Earth's water cycle, returning water to the atmosphere to fall again as precipitation. For irrigated agriculture, ET is a measure of the water used to grow food and can be relied on for irrigation design and scheduling, fertilizer management, field water balances, tracking crop stress, and for managing drought impacts. ET is the most difficult component of the water cycle to measure, and, as is true for any quantity, if it cannot be measured, it cannot be managed. S. 2568 and H.R. 4832 would enable USGS, in partnership with entities like OpenET and other scientists, practitioners and agencies, to solve that measurement gap.

OpenET is a satellite-based ET cloud computing and data services platform that builds upon decades of research by NASA, USGS, and U.S. Department of Agriculture (USDA) to provide historical, current, and forecasted ET data at the national level and at field scales. DRI co-developed the OpenET platform and is a lead partner due to our extensive expertise in remote sensing and hydrology, and our strong partnerships with federal and state research and natural resource agencies.

OpenET uses publicly available data and the best available science to provide satellite-based ET maps through an easily accessible web-based platform where users can explore ET data at the field scale for millions of individual fields or at the original quarter-acre (30 x 30 m) resolution of the satellite data. While satellite-based field scale ET data already exist for some regions, these data are expensive, not readily available over large areas or time histories, and they often lack consistency, transparency, and reproducibility. The OpenET consortium and software platform was established to address these issues.

The word "open" in OpenET stands for the open, collaborative, and transparent development of the platform. OpenET brings together many of the leading scientists and developers behind satellite-based mapping of ET. It is also a core objective of OpenET to provide open access to ET data beyond government to farmers, practitioners, and water managers alike.

The OpenET technical team combines expertise in satellite-based estimation of ET, cloud computing, and user driven website design. It includes approximately 40 scientists and practitioners from NASA, DRI, USGS, USDA, seven universities, Environmental Defense Fund and partnership with Google. The broader OpenET community includes partnerships with more than 100 stakeholder entities and organizations. This includes growers and agricultural groups making irrigation scheduling and other decisions at the field scale, water district managers building water accounting and trading platforms, non-profit groups working with agricultural producers on conservation strategies, and state and federal agencies making drought and water resource assessments at local to national scales.

S. 2568 would establish an Open Evapotranspiration Data Program at USGS that would build upon the foundation and scientific collaboration established by OpenET to produce and distribute satellite-based ET data, both to advance the quantification of ET and to facilitate use of these data across the U.S. Specifically, it would authorize up to \$14 million per year to:

- Provide agricultural producers, water resource managers, and the public with field scale ET data over large areas and time periods;
- Sustain and advance the technology and underlying science for satellite-based ET measurement;
- Coordinate among federal agencies on the incorporation and use of data from OpenET into national to local scale water planning, decision support tools, and reports;
- Produce continuous and consistent ET surfaces that aren't fragmented in time or space based on funding source, location, or method used.

S. 2568 also builds upon large investments by NASA, USGS, and NOAA to develop, launch, and operate a constellation of Earth-observing satellites, and to establish the ground data systems required to capture, process, store, and distribute satellite data. Landsat data is the primary satellite dataset used by the OpenET platform, and at 50 years, provides the longest continuous space-record of images of Earth's land surface in existence, and at the field scale - the scale that crops and water are managed. OpenET is pleased to see S. 2568 further build on these investments in earth observation data for the purpose of maximizing the nation's water resources for people, agriculture and nature.

Demonstrating the Value of Satellite-based ET Data

Satellite-based ET data is already being used to mitigate drought impacts and shape local solutions to water challenges in the West, with early applications of OpenET providing some good examples. A common goal for OpenET use cases has been to identify solutions that balance water supply and demand while supporting sustained agricultural production and vibrant rural economies. Open and equal access to ET data fosters greater collaboration between water management agencies and communities.

For example, OpenET is being used to assess drought impacts and better understand how changes in irrigation practices may help to achieve water management goals in the Upper Colorado River Basin states of Utah and Wyoming. The OpenET team is participating in a Utah Division of Water Resources pilot program with academics and agricultural producers in Enterprise Valley to assess new irrigation and monitoring technologies to support groundwater management. In Montana, OpenET is being used to support the development of comprehensive water budgets for stakeholders in the Bitterroot Valley and to assess low river flows and Whitefish die-offs in the Upper Yellowstone River. In California's Central Valley and San Francisco Bay Delta regions, OpenET data are being used as the foundational water use dataset for incentive-based water accounting, conservation, and credit programs. In Oregon's Harney Basin, ET data have been used by farmer and State Representative, Mark Owens to design more efficient irrigation systems that have resulted in 25% less applied water and 20% less power use, all in an effort to slow groundwater depletion and support groundwater management in the basin while reducing pumping costs for farmers.

OpenET use cases aren't limited to just the Western U.S. In the Mississippi Delta, OpenET partners are working with USGS to support groundwater and nutrient modeling efforts to better understand groundwater withdrawals and nutrient loads. OpenET provides a pathway for ET data to be readily available for use to manage water and fertilizer together to substantially reduce fertilizer use and save farmers money, with important benefits both to farmers and water quality in the Gulf of Mexico. For more information on OpenET use cases see - <https://openetdata.org/openet-use-cases>.

As the drought in the West persists and water demand is continually increasing, having a clear understanding of our water use is critical for developing and implementing drought monitoring, management, and mitigation programs. S. 2568 would help to advance and further the reach of important tools like OpenET that can improve water management and give farmers and communities the transparent and easily accessible data they need to develop locally-driven solutions that are based on best available science.

With the constant threat of frequent and prolonged droughts that we're seeing, we need all the tools we can access to support and sustain agricultural production. One uniquely valuable tool is ET data that are accessible to individual farmers, water district managers and state and regional scientists alike. Over the next four years, it is critical that we are able to develop accurate water use and budget information at local to national scales for a secure agricultural future.

Additional Information on Satellite-based ET Approaches

Built on Publicly Available Data: The satellite-based ET mapping approaches that would be supported by S. 2568 (like those available via the OpenET platform) are built using only publicly available data, including satellite, weather, climate, soils, vegetation, and parcel data. Within OpenET, any data used by private parties to query datasets or produce reports remain secure in custom user databases where they are only available to the user.

Accuracy and Peer Review: OpenET has completed the largest, most rigorous satellite-based ET intercomparison efforts to date, which included ground-truthing the data with over 140 ET measurement stations to assess overall accuracy. The stations span a diverse range of crop types and natural ecosystems, providing a robust assessment of model accuracy across varying conditions. Results from the accuracy assessment showed that the satellite-based ET models included in OpenET were within 9 percent of the field measured value on an annual basis, and within 17 percent at a monthly timestep. For perspective, errors reported for measurements of stream and river flows across the country generally range from 5 to 20 percent. These results were published in 2021 by the OpenET team as a peer-reviewed, open access scientific paper in the Journal of the American Water Resources Association and is included in this testimony. The OpenET consortium includes the world's leading experts in the field of satellite-based ET mapping. The OpenET technical team has collectively published over 600 peer reviewed papers on ET and includes the primary developers of the satellite-based ET models commonly used by government, academia, and industry. The OpenET team is committed to open and transparent science. For more details on the accuracy assessment and methodology see

<https://openetdata.org/accuracy>.

Sustainability and Continued Advancement of the Science: Sustaining and advancing the underlying science, automated production of transparent and consistent ET data at national scales, and stakeholder engagement with water agencies and agricultural producers are core components of this legislation and underscores the need for the federal government's support and participation. Additional collaboration with federal agencies, extension specialists, agricultural producers, and university partners to conduct additional accuracy assessment for key crops and regions is also needed. A primary goal for OpenET going forward is to continually provide the best available science-based estimates of ET at scale and with consistency and transparency. This requires teams of researchers and software developers from across the federal government and working collaboratively with the academic community, water resource managers and agricultural producers to maintain and update software and data archives as the science, underlying input data, validation sites, and computing platforms advance and evolve. The OpenET consortium looks forward to partnering with the USGS and the broader science and practitioner community to continue to advance ET science with support from S. 2568 and will incorporate rigorously tested new models and approaches into the OpenET platform over time when they serve to improve the accuracy or performance of the estimates for certain regions or land cover types.

Conclusions

Today, access to accurate, timely satellite-based data on the amount of water used to grow food is very limited and often expensive, keeping it out of the hands of most farmers and local decision-makers. OpenET will fill a critical information gap in water management at a time when it is urgently needed by providing a cost-effective tool for agricultural growers to sustain water supplies and agricultural production.

The biggest threat to U.S. agricultural producers today is drought and lack of data to develop accurate water use and budget information. We must find the most cost-effective ways to support and sustain water supplies for agricultural production. S. 2568 will support development of the data needed to enable investments and programs to improve the availability and reliability of our water supplies for agriculture in ways that have not previously been possible.

Supporting S. 2568 will help farmers and water managers adapt to the more intense droughts that we are now experiencing and develop more accurate water budgets and innovative management programs to ensure adequate water supplies for agriculture, people and ecosystems.

We thank Chair Cortez-Masto for her vision and insight to advance this important legislation, and the Committee for their time and interest in evapotranspiration. We are committed to working with the Chair under her leadership and stakeholders to enhance the legislation during the legislative process.

Support for OpenET from Western Water Agencies, Councils, and Agricultural Producers

“Tools to measure and monitor agricultural and other outdoor water uses and needs are increasingly important for present and future management of scarce water resources, particularly given recurring drought. OpenET will provide credible, transparent, automated, easily accessible consumptive water use data, through a broad network of collaborators also developing and refining operational applications. No such system can provide more easy access to more timely data with more refined spatial coverage. Currently, access to satellite and ET data is limited and expensive to process and interpret for many water users and decision-makers.”

—*Tony Willardson, Executive Director, Western States Water Council*

"The Harney Basin is running a groundwater deficit of 120,000 acre-feet to 130,000 acre-feet per year. We have used ET data to gain a better understanding of our water consumption and design more efficient irrigation systems that use about 15% less water. This could translate to a savings of 18% to 20% on electricity costs for pumping, too. With the demands on water from a growing population and feeding more people, we have to figure out how to get the best value from every drop of water. ET data is crucial to providing this information... As the Western United States experiences a more water-constrained environment and effects from climate change, having thorough and accurate data is imperative to understanding how we must operate. Production and access to OpenET data, as described in S. 2568 is the most effective way to broadly distribute this information and to better understand evapotranspiration for water management. We need to know what we have in order to best utilize our resources.”

—*Oregon State Rep. (R) Mark Owens. Owens owns or manages 3,200 acres of farmland in Crane, OR.*

“If you give farmers better information on when they should and shouldn’t have their water on, you’re going to save water. I think that’s the great value of OpenET.”

—*Denise Moyle, Nevada Alfalfa Farmer*

“Measuring water use in the Delta with traditional ground-based tools is a fool’s errand because of the region’s unique hydrology. OpenET provides us the ability to gain a more precise, timely and meaningful measurement of water use in the Delta. OpenET will be of great value for Delta farmers, state regulators, and policymakers as we collaborate to better manage our common vital water resources for our future.”

—*Brett Baker, Sixth-generation Pear Farmer and Attorney, Central Delta Water Agency*

"Every five years, the Bureau of Reclamation is tasked with creating a report that summarizes water use and loss for the Upper Colorado River Basin states. Currently, there are several satellite-based methodologies to measure water, many of which will be incorporated into OpenET. Consequently, OpenET will serve as a valuable tool for us to test and compare ET measurement methodologies to determine the best approach for future studies."

—*James Prairie, Hydrologic Engineer, U.S. Department of Interior, Bureau of Reclamation*

"To comply with the new groundwater law in California, it's imperative to have accurate, transparent water use data to serve to build a groundwater budget. But currently ET data can be very expensive to acquire from consultants or universities, and the methodologies are often inconsistent and unclear. Consequently, Rosedale turned to OpenET for accurate parcel-level ET water data at a lower cost to build an online accounting platform for our landowners to more easily manage their own groundwater budgets. Because the OpenET project has brought together a team of leading experts on several approaches for measuring ET, I'm confident it will become the de facto source of water data among landowners and water managers alike."
—Eric Averett, General Manager, Rosedale-Rio Bravo Water Storage District (California)

"OpenET is a great step forward for managing water needs in a time when demand far surpasses supply. Helping our farmers and ranchers more effectively manage their water use not only helps their crop and bottom line but creates opportunities for more water to remain in our river systems to benefit both people and nature."
—Aaron Derwingson, Water Projects Director, Colorado River Program, The Nature Conservancy

"Gallo has invested substantially in ET data research because it enables us to use water much more sustainably as we face more frequent heat spikes and increasingly severe droughts. Working with USDA and NASA, we have experimentally used ET data to adjust irrigation amounts to actual vine water needs and to reduce applied water by up to 20%. But we need OpenET to be able to scale this application to all our vineyard acres."
—Maria Mar Alsina, Research Scientist, E. & J. Gallo Winery

"The development of OpenET is fundamental to filling a data black hole related to consumptive use of water. We are thrilled with the prospects it provides for improved, informed water management at the scale of basin and farm, alike. The passage of S. 2568 is crucial to making every drop count, at a time when every drop really does count."
—Bart Leeflang, Central Utah Water Conservancy District, Colorado River Program Manager

"We learned from the last major drought in California that reliable water data is almost as critical to farmers and water managers as the water supply itself. The launch of OpenET during our current, even more severe drought will be invaluable in helping farmers and water managers plan for agricultural water needs in a way that just wasn't possible before."
—E. Joaquin Esquivel, Chair of the California State Water Resources Control Board

"The Nevada Division of Water Resources strongly supports the continued development and public accessibility of OpenET. This outstanding program directly benefits water users throughout Nevada and the west who strive to improve efficiency and conserve water. Public access to these data will be increasingly vital to support water users and responsible water management needs into the future."
—Adam Sullivan, Nevada State Engineer, Nevada Division of Water Resources

“As a headwater state with seven interstate compacts and three court decrees prescribing the flow of water out of state, the State of Wyoming has numerous obligations for reporting water use. Yet, like many states, Wyoming has limited access to data or resources helpful in meeting our needs. OpenET would provide the State of Wyoming with more accurate estimates of key variables needed for reporting water use and consumption. If funded as proposed and made available to users at little or no cost, we would have a tremendous tool for calculating and reporting water use while helping meet our compact requirements.”

—*Greg Lanning, Wyoming State Engineer, Wyoming State Engineer’s Office*

“OpenET has been developed in close collaboration with partners from agriculture, cities, irrigation districts and other stakeholders across the West. OpenET is a forward-looking tool for supporting TU’s goals of water conservation and meaningful water allocation to promote the sustainability of both agriculture and watershed health.”

—*Laura Ziemer, Senior Counsel and Water Policy Advisor, Trout Unlimited*

“OpenET will allow water managers to assess how much water is being used via a cost-effective and easy-to-use web-based platform, filling a critical data gap in water management across the U.S. The Authority believes OpenET is a valuable tool for federal, state, and local policymakers and water users.”

—*Zane Marshall, Director, Water Resources, Southern Nevada Water Authority*