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What Constitutes a Drought and Why It Matters

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Over the last fifty years, California's governors have officially declared four different droughts. Each drought occurred in different years and different contexts, but none of the declarations were based on any formal criteria that determine when a dry season becomes a drought. According to the California Department of Water Resources, "There is no universal definition of when a drought begins or ends, nor is there a state statutory process for defining or declaring drought."

So how do we know that a drought is a drought? The fact that this is an open question is particularly surprising because California has one of the most carefully engineered water systems in the world. California's water resources require intensive monitoring by both staff and technological instruments at carefully scheduled intervals. To understand whether this system is working well, Californians need a better understanding of when there is not enough water for varied uses.

Drought Definitions and the Importance of Water Measures

Currently, many different groups are required to take water-level measurements and interpret them carefully. The lack of a formal definition of drought leaves room for different interpretations about whether or not a drought exists. Yet such interpretations are what government, industry, and residents use to decide how much water is available and whether or not water levels are insufficient for their specific needs.

Government agencies, like the Department of Water Resources and the State Water Resource Control Board, rely on measurements of precipitation, runoff, and snowpack to make judgments about how much water is available. These agencies are important and their conclusions carry a lot of weight, but the measurements they make are not the only ones that can be used to make sense of California's water resources and whether or not a drought exists. Without any agreed, formal definition for drought, alternate methods of measurement and interpretation can be mobilized by different experts and stakeholders.

Overall, government agencies' measurements are derived from a long, complicated history of reclamation and are integral to the complex water system that Californians interact with on a day-to-day basis. Yet current measures have their limitations. Understanding what these measures can and cannot do to pinpoint water resources opens the door for decision-makers and officials to consider different perspectives on how they can and should measure water and declare drought.

The Current System and Alternatives

About 1800 miles of dams, aqueducts, pumps, and managed rivers and streams store and move surface water across the state of California to various users. Reliance on this particular kind of water management system means that the state relies on extensive networks of machines, people, and expertise to collect information about how much water is available.

Data on precipitation, runoff, snowpack, and reservoir storage are used most often because they represent direct changes to the state's water system. Government scientists are interested in measurements regarding surface water because they allow government officials to monitor and manage water resources throughout the state. But existing measures tie government experts to an infrastructure system built fifty years ago — an aging system with problematic requirements and limitations. Reliance on partial measures embedded in this system leads to a partial picture of droughts.

Tellingly, scientists in fields like climatology and geology who are not directly employed by government bodies think about water in different ways. Because they do not have the same historical and political pressures at work, they are able to ask different questions about water and drought — including questions about broader causes and impacts of droughts during an era of climate change. My research finds important gaps between the measurements used by government scientists and those deployed by research scientists seeking broader understandings of drought.

Research scientists are as constrained by California's existing water management infrastructure. For example, research scientists explore the possibilities for long term forecasts and study how phenomena like Atmospheric Rivers are linked to wet years, which can prevent or end droughts. Government scientists, on the other hand, do not have the same freedom because they are responsible for the projection and management of the water currently available in California's extensive system. With resources and time poured into this extremely important task, government scientists are focused on monitoring the hundreds of reservoirs and streams across California with daily (sometimes hourly) measurements to get as accurate information as possible. Rather than atmospheric rivers, they are concerned with the millions of acre-feet stored and transported across the state.

Moving Forward

To begin, policymakers, researchers, and all those that rely on the existing measures should prioritize consolidating information on which indicators are being used, by whom, and to what ends. A significant amount of organizing and compiling will need to take place to address the lack of knowledge about what stakeholders have used in the past and what is in use now. With a better understanding of who is thinking about water in which ways, policymakers and other leaders can begin to create a more systematic approach to understanding when drought begins and ends, the different definitions in circulation, and how various groups should respond.

To truly address this problem, governing bodies will likely need to expand the focus of their measurements and monitoring to include a broader array of the understandings and uses of water and the environment. Expanding their work in this way will require they move away from reclamation-based orientation measures —measures that focus solely on the surface water directly related to their infrastructural systems.

Rethinking infrastructure is always hard. It is harder when the social and political landscape is as much forged by the presence of dams and irrigation systems as the land itself. But there has never been a more important time to understand the scope of the social and ecological impacts of drought than now.

As extreme weather patterns become more frequent because of climate change, interrogating the history of water monitoring practices and their fragmentation is of utmost importance. Closing these gaps and working collaboratively can help policymakers, researchers, and everyone else who rely on California's water system prepare for the future.

Read more in Haley McInnis, "Droughts in California from 1976 – 2017," (working paper, 2019).