A better way to understand drought

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Scientists have few categories at their disposal to describe droughts, which are more complex than mere shortages of precipitation or surface water. For example, some local shortages can be invisible, as when water is transferred into a dry area from a distant source. Other shortages are chronic, with communities continuously requiring more water than is

available, even in wet years. Some water shortages occur when water quality becomes so degraded that even though there may be plenty of water available, little of it is usable. With such variation in conditions, scientists need better language to conceptualize droughts.

To address this deficiency, AghaKouchak et al. propose the idea of anthropogenic drought, which accounts for both natural variation and human actions. For instance, droughts are affected by local decisions about water and land use as well as by such global conditions as greenhouse gas levels and climate change. The authors suggest that scientists think of drought as a process with contributing factors, effects, and feedbacks rather than as simply a final product.

Droughts have far-reaching and often unexpected effects, including damage to local ecosystems, social unrest, and economic loss. The new framework acknowledges that many of these consequences drive the risk of drought even higher. For example, during the 2012–2016 drought in California, less hydroelectric power was generated. Energy providers turned to fossil fuels to meet demand, releasing greenhouse gases into the atmosphere. These emissions can worsen climate change, which in turn can increase the risk of extreme meteorological drought. Climate change has also led to an increase in "hot droughts," or periods that are both hotter and drier than normal. In hot droughts, there is less water, but there is also greater demand for water because of the heat, and so the cycle continues.

The researchers say that human activities and decisions as well as related feedbacks should be integrated into new models that include both water and energy balances to achieve reliable modeling of drought as a process. By understanding how droughts develop as processes, scientists will be able to more accurately predict droughts, they suggest, allowing decision-makers to respond appropriately and sustainably.

More information: Amir AghaKouchak et al. Anthropogenic Drought: Definition, Challenges, and Opportunities, *Reviews of Geophysics* (2021). DOI: 10.1029/2019RG000683

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