How can we prepare for droughts?

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Abstract

Droughts are common in many parts of the world. Yet climate change has made them more severe and difficult to predict. This makes it harder for water suppliers to plan for the future. Currently, they use data from past droughts to make these decisions. But we think it's important to consider future changes as well.

Introduction

Have you ever been thirsty, with nothing around to drink? It's a problem, isn't it? Droughts are like that for everything. Plants and crops don't grow as much. Factories that use water have to cut back on what they make. Families have to decide how to get by with less water. Droughts occur when there is not enough rainfall for a long period of time. They harm farmers, ecosystems, and even businesses.

Droughts are common in many parts of the world. They come and go in most climates. But in recent decades, climate change has changed droughts. It has made them more severe and also act differently. But why is it important to know what future droughts will be like?

If you get a notice you will be out of water for the day, you prepare for it. You can store some water for drinking or save bathwater to reuse in the toilet. The same goes for your water suppliers. They collect surface water and store them in reservoirs, or pump water from aquifers. When they expect droughts, they store more water or ask people to use water more efficiently. Many suppliers plan years ahead for new reservoirs or plants to make clean water from aquifers.

Due to climate change, the risk of drought is changing. So how can people plan and manage their water supply for future droughts? This is what we wanted to find out.

We analyzed drought projections for Texas – a large state in the USA with both wet and dry regions. They show that the conditions there will be even drier and hotter in the future. Water planning needs to adapt to these changes and take future climate change into account. Climate models would be very helpful for that.
Methods

First, we analyzed climate factors in Texas—a good place to study because it rains a lot to the east and very little to the west. We looked at changes from a long time ago using speleothems (in caves) and tree rings. It was easier to get data for recent years from modern climate records. Past changes can help us predict future ones.

We also took into account that the amount of rainfall is not the only reason for droughts. Higher temperatures make droughts worse. Another important factor is how fast the water leaves the soil. People’s increasing needs have an impact as well.

for the curious

Water in the soil can move into groundwater more quickly or more slowly depending on its conditions. Soil water can also move up into the atmosphere, whether through plants or evaporation.

Results

Older data show that Texas was a lot wetter 10,000 years ago, after the last Ice Age. Later, there were many droughts in Texas. Some of them lasted for a decade or longer—these are called megadroughts. More recently, temperatures have kept increasing since 1975.

Climate projections show temperatures continuing to increase. Some of them also suggest less rainfall in the future. In the second half of the 21st century, most models predict Texas will be a lot drier (Figure 1).

Figure 1:

We measured changes in drought using three different methods. These are the results for West Texas. When the index for climate conditions drops below -2, it means that conditions in a typical future year will be like conditions in a past drought year.

What will climate conditions be like in the next 80 years?
Discussion

Climate projections show that Texas will get even drier and hotter in the 21st century. This is because climate change will lead to higher temperatures and make rainfall less steady. Water planning needs to adapt to these changes. In addition, a growing population and an increasing number of businesses also lead to a higher demand for water. This stretches the water supply even further.

What does this mean for the two groups we studied?

1. Farmers need to know what the climate will be like from year to year. They usually rely on their past experience, but better forecasts would help farmers decide what and when to plant. They would also help farmers with long-term decisions like buying or selling land.

2. Water suppliers need to plan for years ahead. Yet in Texas, the state says that water planners only have to make sure they have enough water for droughts similar to droughts in the recent past. They don't have to take future climate change into account. To start doing that, they need a lot of information about future rainfall and temperatures. They also need to know how the amount of water flowing into reservoirs or seeping down into aquifers might change.

Our analysis showed that better climate information can help both farmers and water suppliers. Basing their decisions on the most severe recorded drought has been a good strategy until now. But chances are, an even more severe drought is coming, and water suppliers need to plan for that. Taking future climate change into account when managing the water supply is important.

Conclusion

Water is vital for life. Many global climate models show that it will keep decreasing. This is why it’s very important to conserve it. Here are some things you can do:

- Take shorter showers – or if you are taking a bath, just fill it partway!
- Don't leave water running when you are not using it.
- Catch water from your roof when it rains, then use it to water your plants later.
- Find out where your water comes from and how long that supply is supposed to last during a drought.

REFERENCES


National Geographic: Understanding Droughts https://www.nationalgeographic.org/article/understanding-droughts

U.S. Drought Monitor https://droughtmonitor.unl.edu

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Why is it important to predict droughts in the future?

What is the downside of the current water planning strategy?

Why are climate models useful for water planning? What else can they be useful for?

We mentioned some ways to conserve water; can you think of any others?

What are some drawbacks of storing water? Research your answer.

Aquifer – an underground layer of sand or rock that holds water. Some aquifer water needs to be treated to remove stuff like salt before it’s drinkable.

Climate records – since modern times we have had stations that measure and record the climate conditions.

Drought – long periods of time with low water supply. There are several types of droughts: a) meteorological – the rainfall is less than average for a long time; b) agricultural – the drought affects the crops; and c) hydrological – water reserves get lower, for example in lakes and reservoirs.

Reservoir – a large (usually artificial) lake that stores freshwater.

Speleothem – a structure formed by minerals and water in caves, such as a stalactite or stalagmite. The faster they grew, the more water was available.

Tree rings – these circles in tree trunks show how trees grew from year to year. Researchers often use narrow tree rings to identify droughts during past growing seasons.

Water supplier – companies that supply water to homes and businesses. They collect surface water in reservoirs or groundwater from aquifers, clean it, and deliver it through pipes.