Low Reservoirs and Swollen Creeks: Significant Rainfall Events and the Definition of Drought

Jeremy Brown October 17, 2013

In the last few days, heavy rains and flooding have hit parts of Texas. In Austin, rain forced the cancellation of the Austin City Limits Festival, prompted evacuations in South Austin and Sunset Valley, and flushed more than 10 tons of debris into Lady Bird Lake.

How is it, then, that Texas is still in drought? How is that we can have both swollen creeks and low reservoirs at the same time? How is it that a shortage of water and an excess of water can coexist?

The short answer is that drought is about more than rain. But what exactly a drought is about is far from clear.

Varying Definitions

While all words are constructs, some have more standardized meanings than others. A term like "tornado" refers to a relatively discrete and discernible set of circumstances. There is a general social consensus about what constitutes a tornado.

Not so with droughts. A drought is characterized by the nonoccurrence of a particular event (rainfall) over an extended period of time. In that respect, it is different from other natural disasters like earthquakes and hurricanes that are characterized by the occurrence of particular events (shaking earth, wind and rain) over a short period of time. Unlike a blizzard – which we know has onset from the snow and cold – we generally do not know that we are experiencing a drought until after the drought has already begun.

An online dictionary defines a "drought" as "a long period of abnormally low rainfall, especially one that adversely affects growing or living conditions" or "a prolonged period of scanty rainfall." But what is a "long period?" And how "abnormally low" or "scanty" must rainfall be?

Under this dictionary definition, a credible argument could made that Central Texas is no longer in drought. Through the first nine months of this year, Austin received about 23.6 inches of rain, which is not far off from the 24.56 inches it receives during that same time span in an average year.

Even before the recent storms, if the region maintained the same deviation from the average for the remainder of the year, it would have received 31.47 inches in 2013, or only about 1.22 inches less than usual. That difference would have made for below-average precipitation but would not, on its own, suggest catastrophe.

Indeed, thanks to this week's rains – during which more rain fell on some parts of Austin than any point since September 2010, when the remnants of Tropical Storm Hermine reached town – the region could emerge with above-average precipitation for the calendar year.

Yet by all accounts, Central Texas remains in a drought. Just two weeks ago, the Austin Statesman quoted Austin Water Utility Director Greg Meszaros as saying "this is, in my opinion, the worst drought we've faced in Central Texas, ever."

The article went on to explain that, "[f]or the last two years, Austin has received rainfall amounts close to average. But that rain has not replenished the lakes as much as it used to, due to a combination of parched ground soaking it up and rain simply falling in the wrong places." This statement hints at the subjectivity of the term "drought" and the limitations of the dictionary definition.

Drought can be defined by numerous indicators, rainfall being just one. The National Drought Mitigation Center at the University of Nebraska-Lincoln (NDMC) explains: "When a drought begins and ends is difficult to determine. Rainfall data lone won't tell you if you are in a drought, how severe your drought may be, or how long you have been in drought."

The National Weather Service (NWS) describes drought as "a deficiency in precipitation over an extended period, usually a season or more, resulting in a water shortage causing adverse impacts on vegetation, animals, and/or people ... In practice, drought is defined in a number of ways that reflect various perspectives and interests."

Drought experts have clumped these definitions into four general categories: meteorological drought, agricultural drought, hydrological drought and socioeconomic drought. At any one time, one or more of these types of drought could be in effect. In fact, of these four categories, only the first – meteorological drought – is based on precipitation. The other three are rooted in the impacts that the lack of precipitation has had on the environment or assorted human undertakings.

Fundamentally, a drought is what we say it is. The NDMC recognizes that "there is no single definition for drought." Far from it: a 1986 study estimated in 2011 that more than 150 definitions were in circulation among academics and water professionals. And non-expert weather-watchers could have many more informal definitions. (As proof of weather's enduring popularity as a conversation topic, Lloyds TSB Insurance found in a study that he average Briton spends about 49 hours a year dishing about rain, shine, and the rest).

There are consequences to having multiple definitions. Assessments of drought impacts could reach different conclusions by using different definitions. Public policies could be triggered under some definitions but not others.

Drought at the Federal Level

Despite the benefits of consistency (or at least of clarity), federal laws often refer to "drought," particularly for agricultural aid and emergency assistance, but never define it. The 1944 treaty between the United States and Mexico over the Rio Grande and Colorado River, for instance, exempts Mexico from certain requirements during an "extraordinary drought" but does not unpack the term. *See also, E.g.*, 7 U.S.C. 1961 (authorizing the Department of Agricultural to make emergency loans to drought-afflicted farmers but not defining "drought").

To the extent that statutes do attempt to pin down the term, it is generally by referring to the U.S. Drought Monitor classification scheme. The monitor is a weekly map based on a composite index. It is produced jointly by the National Oceanic and Atmospheric Administration, the U.S. Department of Agriculture, and the NDMC.

The composite index – which blends assorted data and other indices such as the USDA/NASS Topsoil Moisture, Keetch-Byram Drought Index (KBDI), and NOAA/NESDIS satellite Vegetation Health Indices – is used to assess whether an area qualifies for inclusion in one of five drought severity classifications:

- D0 (Abnormally Dry): Going into drought: short-term dryness slowing planting, growth of crops or pastures. Coming out of drought: some lingering water deficits; pastures or crops not fully recovered.
- D1 (Moderate Drought): Some damage to crops, pastures; streams, reservoirs, or wells low, some water shortages developing or imminent; voluntary water-use restrictions requested.
- D2 (Severe Drought): Crop or pasture losses likely; water shortages common; water restrictions imposed.
- D3 (Extreme Drought): Major crop/pasture losses; widespread water shortages or restrictions.
- D4 (Exceptional Drought): Exceptional and widespread crop/pasture losses; shortages of water in reservoirs, streams, and wells creating water emergencies.

State Notions of Drought

State laws frequently establish drought policies without defining "drought." *E.g.*, Tex. Prop. Code § 202.007 (prohibiting homeowners associations from restricting the use of drought-resistant landscaping); Tex. Water Code § 5.509 (authorizing the Texas Commission on Environmental Quality to issue temporary pollution discharge permits to ameliorate "serious drought conditions"); Tex. Water Code § 11.1272 (requiring the development of "drought contingency plans").

Texas statutes do include three isolated definitions of drought, however. A scheme for regulating fireworks specifies that "drought conditions" will be considered to be in effect if "immediately preceding or during the fireworks season [there is] a Keetch-Byram Drought Index of 575 or greater." Tex. Local Gov't Code § 352.051. (The Keetch-Byram Drought Index measures forest fire potential and is one of the indices that the U.S. Drought Monitor incorporates.) *See also* Tex. Local Gov't Code § 352.081.

The statute that creates the Drought Preparedness Council requires the council, when determining whether a drought exists, to consider the following factors: (1) meteorological conditions and forecasts; (2) hydrological conditions and forecasts; (3) water use and demand forecasts; (4) water supply conditions and forecasts; (5) the potential impacts of the water shortage on: (A) the public health, safety, and welfare; (B) economic development; and (C) agricultural and natural resources; and (6) other factors deemed appropriate by the council. Tex. Water Code § 16.055.

In 2006, the council published the State Drought Preparedness Plan, which includes four definitions of drought – meteorological, agricultural, hydrological, and socioeconomic – and which recognizes the conceptual slipperiness of droughts: "Despite the frequency and economic damage caused by drought, the term drought remains difficult to define, and there are no universally accepted parameters because: (1) Drought, unlike floods, is not a distinct event in that it has no clearly defined beginning or end, thereby complicating attempts to define it. (2) The definition of drought varies with its impact on individuals, thus influencing the perception of drought depending upon whom it affects and how they are affected."

One state statute governing water rights directs to the Texas Commission on Environmental Quality (TCEQ) to establish a definition for drought. Tex. Water Code § 11.053. In response, the agency has developed a definition providing that a drought occurs when at least one of three criteria are met:

- The NDMC classifies drought conditions as being at least moderate (or D1, as described above).
- Streamflows at United States Geological Survey gaging stations in the drainage area are below the 33rd percentile for the period of record.
- Precipitation has been below normal for the past three months, as reported in the Texas Climatic Bulletin (Office of the Texas State Climatologist), the demand for surface water exceeds available supply, and a senior water rights holder makes a priority call.

In addition, Texas Government Code § 418.014 empowers the governor to proclaim an emergency disaster. The section does not restrict the type of disaster the governor may proclaim or the severity that any set of circumstances must meet to constitute an emergency disaster. The governor could thus proclaim a drought regardless of whether the circumstances at issue qualified for a certain NDMC classification or satisfied any of Texas' statutory or regulatory definitions of drought. Earlier this month, Governor Perry renewed an emergency disaster proclamation for the drought that he first issued in July 2011. In it, he recited the following as grounds for his proclamation:

- "[R]ecord high temperatures, preceded by significantly low rainfall, have resulted in declining reservoir and aquifer levels, threatening water supplies and delivery systems in many parts of the state;"
- "[P]rolonged dry conditions continue to increase the threat of wildfire across many portions of the state; and"
- "[T]hese drought conditions have reached historic levels and continue to pose an imminent threat to public health, property and the economy."

Climate Change and Drought Definitions

The inconsistencies among drought definitions – and the imperfections within them – will likely become more apparent as Texas and other drought-prone regions experience the effects of climate change.

Climate change is projected to increase both flooding and drought (though generally in different places). Already arid regions such as the American Southwest could become that much more arid. Compounding matters, precipitation may fall at times and places that does not accommodate infrastructure built around old hydrological patterns. (Case study: the Sierra snowpack in California.)

Drought – no matter its exact definition – is at its core about the deviation from some baseline expectation about precipitation or water availability. The technical occurrence of a drought thus depends in large part on where the baseline is set. Some climatologists have theorized that the period for which we have recorded weather data is too short to serve as the basis for generalizations about precipitation patterns and that, moreover, it represents a time period – the last hundred years or so – that was unusually wet.

As a result, our baseline may be too high. What we now think of as drought may not be drought at all. It may be normal. And as climate change sets a new normal, we will need to set a new baseline for droughts or risk categorizing ordinary conditions as extraordinary. Relying on outdated categorizations could distort public policy by deploying emergency resources for what ought to be routine situations and by supporting farmers and others for drought-induced losses that should have been predictable.

drought Texas water

The Energy Center blog is a forum for faculty at the University of Texas, leading practitioners, lawmakers and other experts to contribute to the discussion of vital law and policy debates in the areas of energy, environmental law, and international arbitration. Blog posts reflect the opinions of the authors and not of the University of Texas or the Center for Global Energy, International Arbitration and Environmental Law.

Popular Tags

Texas
water
drought
energy
fracking
endangered species
natural gas
groundwater
court cases
conservation
pollution
TCEQ
LNG
regulation
climate change

Leave a Reply

Your email address will not be published. Required fields are marked *

Name *

Email *

Website

Comment

POST COMMENT